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THE NEW POST OFFICE, NEW YORK CITY.

On Saturday, August 28, the Post Office Department of New York city moved into the new and handsome structure erected at the south end of the City Hall Park. We give herewith an engraving (Fig. 1) showing the south and west fronts, and giving a good general idea of the outer appearance of the structure.

The new post office is by far the finest edifice in this city. The immense size, beauty, symmetry, and strength of the building, and all its splendid internal arrangements, can only be adequately realized by a close inspection. Ground was first broken on August 9, 1869, and it will have cost, when completely finished, about $8,000,000. The general plan is an immense triangle, inclosing an open triangular court. The light from this court extends down through three glass tesselated floors to the sub-cellar. The court is entirely open down to the first story. All the upper stories are well lighted and ventilated by this open space. The building, which is fireproof throughout, occupies 21 city lots, has a frontage on Broadway of 340 feet, on the City Hall Park of 200 feet, on Park Row of 320 feet, and at its southern side a frontage of 130 feet. The hight from the sidewalk to the lantern crowning the dome is 195 feet. The first two

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Fig. 1.—THE NEW YORK POST OFFICE.

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VOLUME XXXIII., No. 12. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, SEPTEMBER 18, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE WOODBURY PATENT.

In our number for January 9, 1875, we gave an account of the strange proceedings before the Patent Office, conducted under the immediate auspices of the then Commissioner of Patents, Leggett, by which that officer granted a patent for an old device that had been in common use for about a generation. This is now known as the Woodbury planing machine patent: the particular claim allowed by Leggett being for a device to press down or hold the lumber while passing through the machine. The patent as granted by Leggett is so drawn as to render every form of planing machine or lumber-dressing machine an infringement of the patent; consequently, if the patent can be sustained, it will be a "Big Bonanza" for its owners; every person who builds a house, or puts up a picket fence, or walks upon a wooden floor, must pay tribute to this patent. A large amount of money was spent in obtaining the patent; and as soon as it was granted, a still larger sum was subscribed, and a joint stock company was organized to endeavor to sustain it. Leading lawyers were retained, and intimations circulated expressive of the determination of the company to exhaust every possible resource which money could command to enforce the patent. Users of planing machines were given to understand that their interests would lie in supporting, not in opposing the patent. By quietly submitting, they were promised the enjoyment of licenses under the patent for a small sum; but in case of opposition, they were liable to loss both of business and property. Some of the users succumbed to this pressure, and took licenses. But the great mass of lumber dealers resisted, and joined in a united effort to test the validity of the patent, in a legal manner, before the courts, forming, for this purpose, a National Committee of Defense. It is now alleged that certain members of the executive committee of this association have turned traitors, have accepted bribes from the Woodbury Company, and are now working, not to defeat, but to uphold the patent.

The following letter, published in the *Northwestern Lumberman*, gives a *resumé* of the situation:

THE CASE OF WOODBURY VERSUS THE PLANING-MILL MEN.

BOSTON, July 26, 1875.

This case, one of the greatest in the whole annals of patent litigation, is still undecided, and, as the months roll on, even gains in interest.

In 1874, Joseph Page Woodbury invented, or claimed to have done so, a flexible pressure bar as an attachment to planing machines, to supersede the heretofore commonly used roller. The advantages claimed for it were that, owing to the close proximity in which it could be placed to the rotary cutter, it prevented any tendency in the board to split or crack, and, from its ready and varied adjustment, admitted of the speedy insertion of any thickness of board or plank.

On April 29, 1873, some twenty-five or more years after his invention, Mr. Woodbury secured a patent in which he claims for his invention four points embodying the principles set forth above. Since the time of securing this patent the Woodbury Patent Planing Machine Company (Mr. Woodbury himself died some months since) have demanded from all users of the aforesaid pressure bars the following royalty:

"The company has determined to charge a preliminary fee of $10 on each machine using said invention, and that all planing, tongueing, and grooving machines, and all molding machines, which cost $300 and upwards, using said invention, shall be considered first class machines, and to pay a royalty of $200 per annum, payable quarterly; and if said quarterly license fees are paid within the first fifteen days from and after the first day of January, April, July, and October, respectively, a discount of twenty per cent shall be made. All other planing machines and molding machines to be considered second class machines, and to pay a royalty of $100 per annum, payable quarterly, subject to the same terms of discount as the machines of the first class; and the company has determined to grant no licenses until the damages and royalty from the date of patent, April 29, 1873, to March 2, 1874, have been fully settled and paid."—*Extract from pamphlet of Woodbury Patent Planing Machine Company.*

"So much for Buckingham!" Immediately on the issue of the Woodbury demands, the leading lumbermen, who were users of these pressure bars, and which they had been using unquestioned for the past twenty-five years (and they claim that similar bars had been in use before the invention of said Woodbury), formed themselves into a National Executive Committee of Defense, with W. N. Greene, of Bronsons, Weston & Greene, Burlington, Vt., as chairman, N. M. Jewett, of Jewett & Pitcher, Boston, Mass., as treasurer, and W. W. Crapo, of Crapo & Co., Flint, Mich., these being the general officers. This association, to defend the manufacturers and users of planing machines against the claims to royalty demanded by the Woodbury Company, soon grew to vast proportions, and now includes the leading lumber and planing mill men in all the principal lumber cities of the Union, numbering in all some six hundred and fifty firms. Then the Woodbury Company endeavored to compromise with the executive committee, hoping thereby to get injunctions against all other users of planing and molding machines, as they would not be strong enough to make a defence; whereat the manufacturers of planing and molding machines, foreseeing the danger and loss to their customers, pledged themselves to support the association, and urged its continuance in the courts. All of which Mr. H. B. Smith, of Smithville, N. J., treasurer of the Manufacturers' Defense Association, most concisely sets forth and ably advocates in his journal, *The New Jersey Mechanic*, of July 1, 1855.

The association have secured for their counsel the Hon. Caleb Cushing, Hon. Wm. M. Evarts, Hon. E. Pierrepont, Hon. B. K. Curtis, and John T. Drew, Esq. The Woodbury Company have Benj. F. Butler, with some others of note.

The association have published pamphlets and papers pithily presenting their position in the case, one of the most witty and concise of which is quoted: "If a man can file a claim to an invention in 1848, have it rejected in 1849, and withdraw his fee and papers in 1852, and then obtain a patent in 1873 under one clause of a law, while he violates another clause, and enlarges his claims and increases his combinations, we certainly think Noah might, through some descendant, get a patent on steamships on a claim of having been the inventor of the ark."

So the case now stands, having developed itself into a very pretty controversy, in which we must confess our sympathies are wholly with the manufacturers and users of planing machines. "But with the strong rests the victory."

One of the later developments of the case here is the withdrawal of two of the prominent lumber firms from the association, to form a combination with Almy and some other inventor of a bar similar to Woodbury's, they to work in unison against the association of which they were former members, in consideration, it is reported, of receiving a liberal share of the stock.

W. F. S

It appears, further, that the Attorney General of the United States has issued an order for *scire facias* proceedings against the Woodbury Patent Planing Machine Company on account of fraud in its procurement. It is suspended until October 15, 1875, to enable the Woodbury Company to file rebutting evidence.

The Woodbury Company has brought suit against several parties using machines. The first case is that of Hancock & Greeley, Cambridgeport, Mass., the trial of which is likely to come on in the course of a year.

SHALL WE EAT THE HORSE?

We have spoken from time to time of the progress of hippophagy in Paris, regarding the same as an experiment which there was no particular need of putting into practice here. It may nevertheless be demonstrated that, in not utilizing horse flesh as food, we are throwing away a valuable and palatable meat, of which there is sufficient quantity largely to augment our existing aggregate food supply. Supposing that the horse came into use here as food, it can be easily shown that the absolute wealth in the country would thereby be materially increased. In France the average price for horse meat, as compared with similar cuts from the steer, is about two fifths less. A horse is there sold to the slaughterer for from $10 to $15.

Estimating from this that $10 is the gross value of every horse in the United States, over and above his worth for working purposes, it remains to be seen how much of that sum may be set apart as to be derived from his utilization for food alone. As will be seen further on, the French butchers derive a revenue from hide, hoofs, hair, etc., and, as is well known, the same portions of the animal find industrial uses here. Placing the value of these parts of the carcass at $7, we find that $3 is the net value of each horse for alimentary purposes. In round numbers there are about ten million horses in the country. According to the above showing, we must add three dollars to the value of each horse, since, in addition to his value as a worker or as a raw material for manufacturing, he now has a new one as food. Consequently the aggregate value of all the horses is increased by $30,000,000. But this accretion to the wealth in the country is of course not convertible into actual money, for, so long as the working value exists, the food value as well as the manufacturing value are practically at zero; neither could be realized without great loss, and hence both are negatived. But there is a certain easily ascertained annual proportion of the horses of which the working value becomes less than the sum of their food and manufacturing values, and this proportion includes the class of which the working value is more than their manufacturing value, but less than the above sum. We may estimate roughly that one tenth of all the horses reach this condition yearly. Then, on this million animals, the food value is directly realizable, and therefore the wealth of the country may be considered as actually increased by the $30,000,000 derivable therefrom.

Moreover, in order that the horses should be available to the butcher, they must not be diseased or worn out. By this the owners are directly benefited, since, while on one hand they are obliged to sell their horses in fair condition, they are saved the expense of keeping the animals when the latter become used up and are unable to do but light work, though requiring more attention and more feed. So also with colts, which, whether they become good or bad horses, cost about the same to raise. If the animal bids fair to turn out poorly, he can be disposed of at once and at a remunerative price. The result of this weeding out in youth and destroying when old, coupled with the facilities which the former affords of selection of the best types, will naturally conduce to the improvement of breeds and a general benefit to the entire equine population of the country.

We can adduce no more striking example of the art of utilization than the mode in which the French deal with their superannuated chargers. On the 1st of January last, France contained fifty horse abattoirs, and during last year consumed 2,850,144 lbs. of horse, mule, and ass meat. The flesh of each horse weighs about 350 lbs. The skin is sold to the tanner for $2.50. The hair of the mane and tail fetches three cents. The hoofs are bought by comb, or toy, or sal ammoniac, or Prussian blue, makers. The tendons are taken to glue factories. There are about ninety pounds of bone, worth sixty cents. The intestines, for purposes of manure, or as food for dogs, cats, and pigs, bring five cents. The blood is purchased principally by the sugar refiners, but also by fatteners of poultry and fertilizer manufacturers. Twenty pounds of dried blood, which is the average, are worth forty-five cents. The fat goes to the soap kettle, or is transformed into genuine "bear's grease," which, delicately perfumed and elegantly put up, fetches some exorbitant prices in the apothecary stores of the United States; or else it is used as harness grease or as lamp oil. The yield is from twelve to eight pounds, at a value of ten cents a pound. Finally, it is said that even the waste flesh is allowed to decompose, and the maggots gathered as pheasant food, but this seems rather apocryphal. These utilizations are of course entirely outside the food supply.

MR. DAWSON'S IDEA OF EVOLUTION.

According to the reporters, the mantle of Agassiz has fallen upon Principal Dawson of Montreal: Agassiz dead, Dawson remains the great American opponent of Darwinism. The honor may be thrust upon him unsought; nevertheless it is not wholly undeserved. At least, in his zealous opposition to the drift of the scientific thought of the day, he has no American rival—that is, in the scientific field.

We do not think the less of him for that. Next to the man who suggests a new and better way of interpreting the facts and phenomena of Nature, the most useful man is he who most intelligently opposes it. It is through such opposition that errors are weeded out, and exact truth ultimately prevails. Occasionally the victory of a good theory, like the undulatory theory of light, may be delayed, and a bad theory kept in power by too strong an opposition: but the damage done thereby is more than offset by the good effected through the criticisms which innovating theories meet at the hands of those who stand by the old. It is for this reason that we rate the opposition of a man like Agassiz next in usefulness to the constructive work of men like Spencer and Darwin. When such opposition fails to shake a new theory, we may rest assured that it is not based upon a delusion.

But the opposition must be genuine to be useful. It must not call something else by the name, and expect the crown of victory for demolishing the substitute. That is a trick of theologians, rarely resorted to by men of Science; but, we fear, it is precisely what Principal Dawson has, consciously or unconsciously, been indulging in. We may be wrong, but to our mind his faculty for misapprehending the position and arguments of intelligent evolutionists is something marvelous in a man of his acknowledged scientific ability. In Dr. McCosh it would not be so surprising.

We refer to his address at Detroit, in which he reviews at great length the geological record of life's origin, and insists that the facts are overwhelmingly against the theory of specific evolution through natural causes. What he understands by evolution is nowhere distinctly affirmed, though it is clearly indicated in numerous passages. That it is very different from the understanding of the living disciples of evolution is plain enough from assertions like the following:

Discussing the insufficiency of evolutionary hypotheses, he says: "We have all no doubt read those ingenious, not to say amusing, speculations in which some entomologists and botanists have indulged with reference to the mutual relations of flowers and haustellate insects. Geologically, the facts oblige us to begin with cryptogamous plants and mandibulate insects; and out of the desire of insects for non-existent honey and the adaptations of plants to the requirements of non-existent suctorial apparatus, we have to evolve the marvelous complexity of floral form and coloring, and the exquisitely delicate apparatus of the mouths of haustellate insects."

Believing Dr. Dawson to be an honest man, the only inference we can draw from a sentence like the last is that he utterly misapprehends the views of modern evolutionists. Certainly nothing in the writings of Wallace, or Darwin, or Lubbock, or Gray can be found to sustain such an ultra Lamarckian method of development. To be guilty of such a mis-statement of the position of another is to forfeit one's claim to any respect as a scientific critic. Even Agassiz' mantle will fail to cover errors so gross and obtrusive.

THE NEW DEPARTMENT OF AESTHETICS.

Professors of the humanities have ever been inclined to look down upon the pursuits of naturalists as little becoming the refinement and dignity of gentlemen and scholars. They have delighted to picture such as turn their attention to the inferior world as eccentric fellows, chiefly employed, like the unfortunate spouse of Lady Jane in the "Ingoldsby Legends," in bug-chasing and poking into all sorts of dirty places for the ugly things that squirm in filth and darkness, solving the infinite (unlike the Breitmann) as one eternal—evolution!

We fancy that the cultivators of polite literature will therefore be taken somewhat aghast by the address of the retiring President of the American Science Association, especially by that part in which he serenely asserts that the chief requirement of the modern naturalist is an inborn and highly developed æsthetic faculty.

In the physical sciences everything depends on accurate observation, with strict logical consequences derived therefrom. In biology, on the contrary, while the basis of knowledge equally depends on accurate and trained observation, the logic is not formal but perceptive. Consequently the first requisite for excellence in this crown of the sciences is æsthetic perception.

Savages are usually keen observers, but they would not make good biologists: they lack artistic tact. The native Australians furnish an illustration. In them the absence of this faculty is complete. Oldfield relates that when one of them was shown his own portrait he called it a ship, another said it was a kangaroo, not one in a dozen identifying a portrait as having any connection with himself. Professor Le Conte gives a higher illustration of the same incapacity in a well known class of travelers. Having penetrated to the inmost chamber of the temple of Art, even the Hall of the Tribune at Florence, they stand in the presence of the most perfect works of art, and gaze upon them with the same indifference that they would show to the conceptions of the mediocre artists exhibited in our shops. Perhaps they even wonder what one can find to admire in the unrivaled collection there assembled. They may be highly educated, and good and useful members of the social organism; but they lack the æsthetic sense which enables one to enter into spiritual harmony with the great artists whose creations are before them.

Such unæsthetic and unappreciative persons would not delight a Ruskin, as students of Art; nor would a professor of rhetoric be hopeful of making poets of them. Professor Le Conte maintains that they would make no better students of biology. The æsthetic character of natural history makes it for ever beyond them, just as it prevents the results of its cultivation from being worked out with logical precision.

This view of the fundamental difference between biological and physical science claims accord with the views of such masters of biology as Helmholtz and Huxley. To the genius of the artistic interpreter more than the patience of the collector its future progress will be due. A rising giant has invaded the domain of polite literature, and the humanities must make room!

LIGHTNING RODS.

We published, in our last number, a very interesting communication from Mr. George B. Prescott, the electrician of the Western Union Telegraph Company, concerning an alleged electrical phenomenon, observed during a thunderstorm, within a private dwelling, and described by a correspondent in our paper of August 14, 1875.

The phenomenon in question consisted of electrical discharges from the water and gas pipes of the dwelling, which was furnished with a lightning rod. The question was as to the cause of the electrical manifestation. Mr. Prescott believed that it was due to the defective connection of the lightning rod with the earth; but in order to satisfy himself fully in the matter, he took the trouble to send an assistant to the locality, and subject the premises, pipes, and rod to actual electrical tests with the galvanometer.

The result was that the lightning rod was found to be so sadly defective in its ground connection that it could not conduct the electricity into the earth, except feebly; and whenever a thunderstorm occurred, the house became charged with electricity, and the current, being unable to pass down the rod, made its way through the building to the water pipe, and escaped through it into the ground. The details given by Mr. Prescott are quite interesting. He advised the immediate connection of the rod with the water pipe, which would thus to serve as an extensive conducting terminal for the rod, ensure the safety of the building, and put an end to the electrical manifestations among the pipes before mentioned.

This case is a representative one, as the rod was put up in the same defective manner as are the majority of rods, that is, the bottom of the rod was simply stuck down a few feet into the ground or rock, and thus practically insulated.

We have repeatedly advised our readers that a lightning rod, in order to serve as a protection for a building, must have a large conducting terminal in the earth. This terminal may consist of an iron water pipe, as in the present case, or a very considerable extension of the rod itself into wet or damp earth; or a trench, filled with iron ore or charcoal, may be made available.

The aggregate annual losses of life and property in this country, by the striking of buildings by lightning, is immense, but might be almost wholly prevented if properly arranged conductors were generally employed. But it is evident that a more intelligent class of lightning rod men are needed in their erection; and it is probable that electrical instruction must also be given in our common schools before much improvement can be expected.

If a man, employed to put up a tin pipe to conduct the rain water from the roof to the cistern, were to solder up the bottom of the pipe, thus preventing any flow, his work would be rejected, and he would be stigmatized as a fool. But this is substantially what our lightning rod men are doing every day. They put up rods for the alleged purpose of conducting the electric fluid, but seal or insulate the bottoms of the rods so that the fluid cannot flow into the ground; and the majority of employers are so ignorant of the subject that they are unable to detect the fraud.

The known laws that govern the flow of electricity are almost as simple as those relating to water. If a proper connection exists between the rod and the earth, the building will be protected, for electricity will flow through the rod with the same certainty that water will pass through an open leader from roof to ground. But if the bottom of the pipe be sealed, the water cannot run; and if the bottom of a lightning rod be sealed or insulated, the electricity cannot flow.

Tests of lightning rods with the galvanometer, as directed by Mr. Prescott, will always show whether they are safe or not. But it may be taken for granted, without a test, that a rod is unsafe which merely has its bottom stuck down a few feet into dry earth. We repeat, the golden rule for safety is to have the bottom of the rod placed in connection with a large mass of conducting material in the ground.

ANOTHER VIEW OF MR. CROOKES' LAST DISCOVERY.

In a recent issue we gave a summary of Mr. Crookes' recent observations on the behavior of delicately suspended pith balls when acted on by a beam of light. In a vacuum the pith balls, and disks of cork similarly suspended, seemed to be repulsed by the light under conditions which demonstrated, Mr. Crookes asserts, a hitherto unrecognized power of light.

Similar observations with substantially the same apparatus were made fifty years ago, so that the discovery is not new if true; it simply reasserts what was generally believed when the Newtonian theory of light prevailed, namely, that luminous radiations are capable of exerting a direct push upon matter. It is strikingly inconsistent, however, with the now dominant theory of light; and according to some careful observers, it is equally inconsistent with fact. Professor Osborne Reynolds suggests that the action of the pith balls or disks is due to the evaporation of some fluid on the surface of the disks, the recoil of the evaporating particles, as they leave the disk, driving it back.

A better explanation, because better sustained by experimental evidence, is that given by Professor Dewar, of Edinburgh, who claims that the heating of the disks is the efficient cause of the action observed. In his investigation Professor Dewar used substantially the same apparatus that Mr. Crookes employed, simply changing the composition of the disks and interposing certain substances having well known effects upon the radiations.

Placing a candle before the apparatus so as to cause a large deflection, he first interposed a vessel of ordinary glass, and the deflection was diminished. On filling the vessel with water, the disks ceased to be deflected. Now it is well known that water, though transparent to light, is almost opaque to heat.

The experiment was then reversed. A smoked piece of rock salt was interposed, shutting off the light but allowing the heat to pass through. The disk remained deflected: so likewise when a solution of iodine in carbon bisulphide was used, a substance opaque to light but transparent to heat. These experiments show that it is not the luminous radiations which have power to move the pith balls, but the obscure radiations commonly known as heat rays.

The next question was: How do the heat rays produce the motion? To test this, disks of rock salt (transparent to heat) and glass (transparent to light) were substituted for those of pith or cork. When a beam of light was thrown upon the clear salt no motion ensued, the radiations passing through unabsorbed. When the light was received on the glass, part was arrested, the glass was heated, and the disk was deflected. The effect was reversed when the back of the rock salt disk was coated with lampblack. The radiations were absorbed by the lampblack at the surface of contact; the lampblack was heated and, by conduction, heated the salt, and the result was (at first) repulsion. Were the lampblack a good conductor, it would heat through first, and then there would be repulsion from that side, or apparent attraction. This in a vacuum: at ordinary pressure the motion is always forward from the side of the disk most heated.

Other experiments were made with disks of sulphur, clear and ordinary; and with transparent disks coated on one side with white phosphorus, which is opaque to the ultra-violet rays. In the latter case, when the disks were acted on by light, chemical action ensued with disengagement of heat, resulting in a motion of the disks away from the side heated. The reverse was demonstrated by bringing ether near a disk; and doubtless the same effect would have been produced by a piece of ice. The chilling substances caused a radiation of heat from the side of the disk toward it; the distant side became the heated one, and apparent attraction was the result.

Professor Dewar's explanation of these phenomena is simple, and does not involve any new or inexplicable power in radiations. The apparent attraction of the disks by light under ordinary pressure is caused, he says, by convection currents. The air or gas in front of the disk is heated, and, rising, tends to cause a vacuum; the disk consequently advances, pushed forward by the power that drove the ship of the "Ancient Mariner":

> "The air is cut away before
> And closes from behind!"

In a vacuum the effect is different: the disk is repulsed instead of attracted—repulsed by the recoil of the residual molecules of the gas, which leave the heated side of the disk at an increased velocity after impinging upon it in the course of their travels.

"What takes place is this: The particles of the gas are flying about in all directions, with a velocity which depends on the temperature. When they impinge on the heated disk, they go off with a greater velocity than those which go off from the colder side, and hence there is a recoil of the disk. When the gas is at all dense the particles get a very short way before they are met by another and sent back, and so the velocity gets to be a common velocity before any visible action takes place. When the gas is rare, the particles may get a long way off before they meet others, and so the action becomes perceptible."

The vacua employed by Professor Dewar were formed by the charcoal method, the density of residual gas being reduced to one four-millionth of its density at ordinary pressure. In such a vacuum, the average path between two collisions is about 1 foot against an average of one four millionth of a foot at ordinary pressure. It will be seen, therefore, that the particles may have relatively a very long way to travel after leaving a disk.

For the benefit of those who have dreamed of securing a profitable direct motive power derived from solar radiations, it may be added that the total work done by the radiations in these experiments did not amount to the five-millionth part of the available energy received by the movable surfaces.

EXPLOSIONS IN GUNPOWDER MILLS BY ELECTRICITY.

A correspondent remarked, some time since, that the mysterious explosions of some powder mills may probably be due to an electric spark given off by persons dressed in woolen clothing, who, when the air is dry, may (by friction of their clothing or feet) produce from their finger ends a spark of electricity sufficient to ignite a gas jet. He submitted the question whether it would not be possible that men at work in powder mills may create so much electricity in their bodies that, when their hands come in contact with metallic conductors, it may be, if not sufficient to ignite powder, enough to ignite some inflammable gas generated from the chemicals.

This letter has drawn the attention of the London *Chemical Review*, which states that in England they have often seen in American journals the statement that an electric spark, sufficient to ignite gas, may be given off by the human hand: but the editor says that he never heard of such cases on his side of the water. We know that the air in England and all the countries of Western Europe is very damp, owing to the prevailing west winds and the absence of extensive areas of dry land, blowing over which the wind would become very dry, as are our west winds, coming over our prairies.

It is asked what inflammable gas may be generated in the manufacture of gunpowder? To this, it may be answered that, in the manufacture of fulminates for percussion caps, inflammable vapors, as nitrous ether, etc., are given off, while the dust of gunpowder and even of charcoal, when floating in the air in a proper quantity, may form an explosive mixture. Even the dust from the mineral grahamite, which in its character is very similar to gunpowder charcoal, has repeatedly exploded in the mines in Western Virginia, when mixed with air in the right quantity. It is well known among electricians that a weak electric spark will more easily explode gunpowder than a strong, intense spark; the latter will scatter a heap of gunpowder without igniting it, but, when the spark is weakened by substituting for a part of the conducting metal a less conducting material, such as water or a moistened thread, then ignition will readily take place.

We acknowledge that we have no positive evidence that powder mills have actually been exploded by electricity; but the possibility of such a cause was only suggested in our paper, and it must be admitted that this suggestion is not unworthy of serious attention.

Resignation of Commissioner of Patents.

The daily papers announce the resignation of Mr. J. M. Thacher, the present Commissioner of Patents, to take effect October 1. His successor has not yet been announced by the President, but the name of R. H. Duell, of Courtlandt county, N. Y., is mentioned as the probable appointee. Mr. Duell is reputed to be a lawyer of considerable ability as well as a first class politician. He was formerly a member of Congress.

NEW RUSSIAN GUN.—A great cannon, lately built at the works at Obonkowsky, has cost $65,000, and weighs 40 tuns. It is a breech loader, entirely in crucible steel, 20 feet 6 inches long; its largest ring is 57½ inches in diameter, and the tube has thirty-six grooves.

Continued from first page.

floors and the basements below are occupied by the post office, and the third and fourth floors by the United States courts and offices (the interior of the United States Court is shown in our Fig. 2). There are ten elevators for mail matter, and four for passengers. The building looms up grandly above the structures in the vicinity, and attracts and interests the attention of every beholder. The solid walls of the post office contain half a million cubic feet of granite. Every credit is due to the great ability shown by A. B. Mullett, formerly United States Supervising Architect, in perfecting the plans of the building, and giving to New York an edifice that will be a continual source of pride to it.

The business transacted in the post office in this city is something marvelous, being nearly double that of any other city in the Union. The average number of domestic letters received and distributed daily is 300,000; the number of foreign letters received, 30,000; the number dispatched, 35,000; and the number of local letters received and distributed, 120,000. There are 5,795 lock boxes for letters, and 372 lock boxes for newspapers. At the post office and stations there are about 1,300 employees, and 390 carriers are employed. In the post office proper there are 600 clerks.

Experience has shown that Mondays and Thursdays are generally the heaviest days. To properly manage a business so vast and so complex as that transacted in the New York post office requires the highest order of executive ability, combined with a quick perception of details needed to systematize the work so as to make one harmonious machine.

THE ELEVATORS.

One of the most noticeable features of the interior of the building is the telescopic hydraulic elevator. Eight of these are used for handling the mails, and four for passengers. Of the latter the two principal ones are located in the wells of the grand spiral stairways which occupy the pavilions at either extremity of the north or park front. The elevator cars are of elaborate design and finish. Their most striking peculiarity, however, is their mode of operation. Imagine an iron telescope about 18 inches in diameter and 30 feet long when closed; set the small end up, with a car resting on the eye piece. Now this telescope, being strong enough to resist great internal pressure, has its three polished wrought iron slides working through watertight stuffing boxes; and it is obvious that, when water is forced into it, the slides will be forced out and up, and the car, resting on the upper one, will in consequence be elevated. To lower, the confined water is permitted to escape, when the weight of the car and slides causes a prompt descent. These operations are controlled by a threeway valve, actuated from the car by a guide rope in the usual way; and by its means the speed in either direction can be instantly adjusted to any rate, from an almost imperceptible motion to 100 feet a minute with perfect ease and steadiness.

The engraving, Fig. 3, represents one of the large passenger elevators extended to its full hight. Their range is from the first to the fourth floors, a distance of about 80 feet.

These elevators were built by Messrs. Davidson & Mars, of 36 Courtland street, New York city.

The foregoing engravings are all executed by the new process of the Photo-Engraving Company, No. 62 Courtlandt street, this city, an account of which we give in the subjoined article.

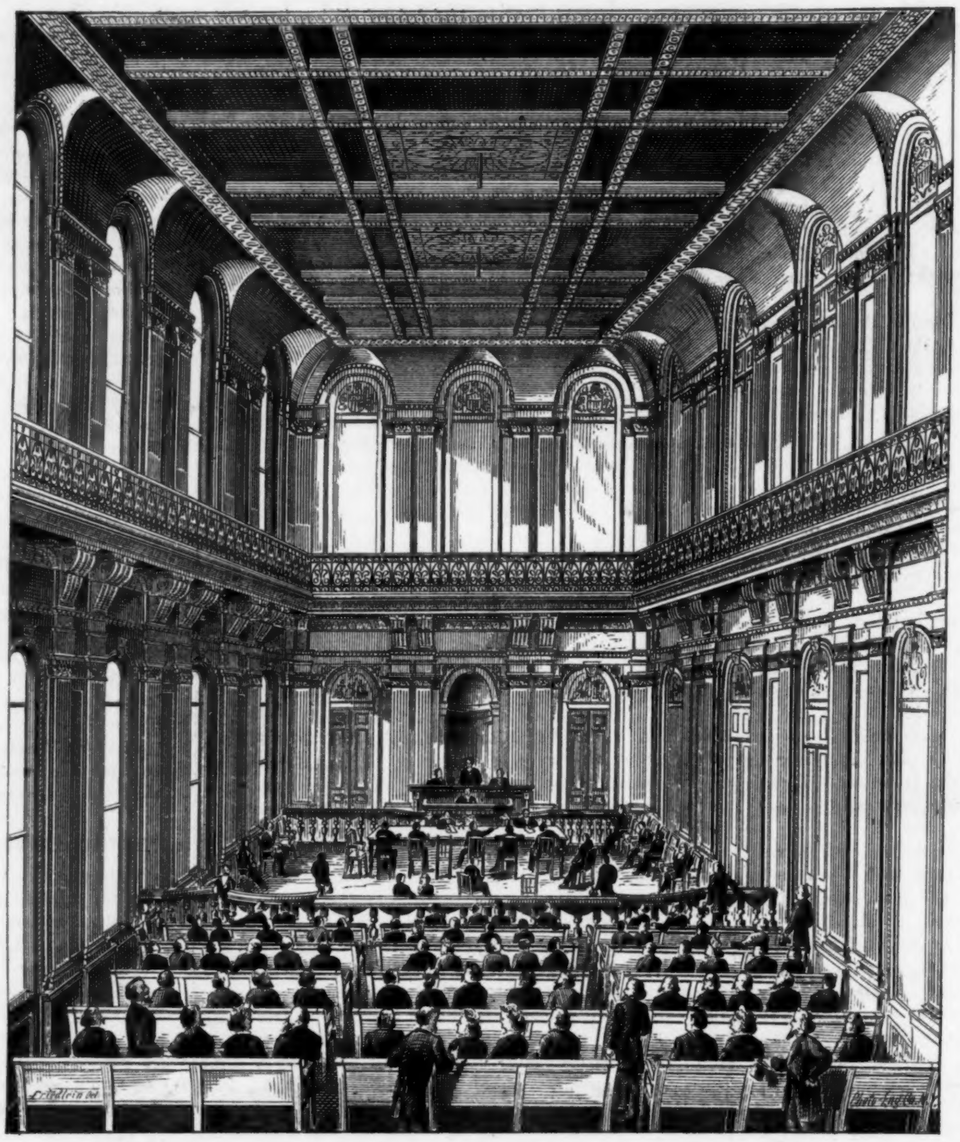
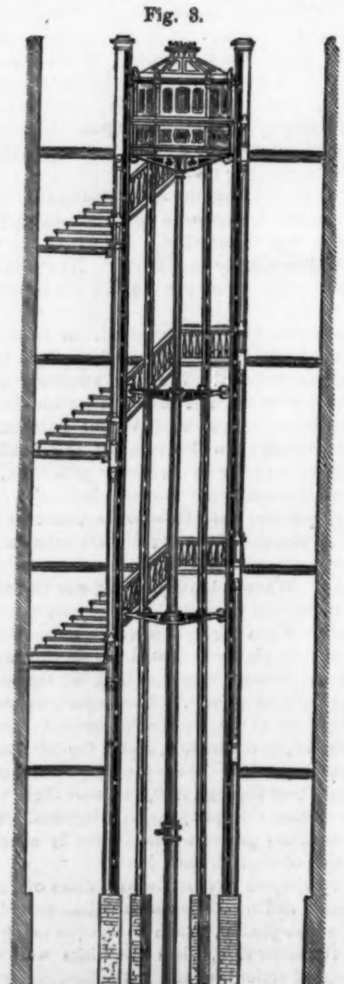


Fig. 2.—THE UNITED STATES COURT, POST OFFICE BUILDING, NEW YORK CITY.

Fig. 3.



THE HYDRAULIC ELEVATORS, NEW YORK POST OFFICE.

Photo-Engraving.

The production of metallic plates engraved by the aid of light, for use in printing, was attempted as early as 1813, by Niepce, about twenty-five years before the art known as photography was invented. Since then, many attempts at photo-engraving have been made, and numerous specimens of more or less merit have been exhibited; but it is only within the last few years that this art has been brought to such a degree of perfection as to serve a useful purpose.

Among the various inventors in this field, John C. Moss, superintendent of the Photo-Engraving Company, of this city, seems to have achieved the highest success. Being both a practical photographer and a printer, his experience gave him great advantage in his endeavors to prepare plates, by means of photography, to be used on the ordinary type press. He commenced his experiments with great enthusiasm, in the spring of 1858: but it was not till ten years later that he had so far succeeded as to get his process into practical working; and then the want of means compelled him to carry on his operations in the same apartments where he lived, in Jersey City.

After prosecuting his work for a year or more under these embarrassing circumstances, and subsequently, for a few months, in a loft on Cedar street, in this city, his plates had attracted so much attention that he was induced to unite with others in the organization of a company for the purpose of carrying on the work upon a large scale. Accordingly the Actinic Engraving Company was formed. But this did not prove a financial success; and after a year and a half it was abandoned.

There are some inventions which, though of great value, are slow in winning their way to public favor. This proved to be one of them. There existed in the minds of many publishers a strong prejudice against process engraving, due to the fact that several processes had been introduced, of which they had made trial with very unsatisfactory results. Time was required to prove that Moss' process was not like the others.

Another and perhaps greater obstacle was met in the reluctance of artists to adapt their style of drawing to the requirements of this new art. They had been accustomed to make their drawings with pencil and brush, often hastily, leaving the work to be perfected and finished by the slow and tedious toil of the wood engraver. Now they were asked to furnish pen and ink drawings, executed with the care and exactness necessary to secure the desired result. Their first attempts were generally failures, increasing the indisposition to change.

But Mr. Moss had pursued his invention too long to be disheartened by these obstacles and delays. A new organization—the Photo Engraving Company—was formed, something more than three years ago. Expensive apparatus and machinery have been introduced, important parts of which have been invented and constructed expressly for this use; workmen have been carefully trained to perform their respective parts; a corps of artists, patiently instructed, have become skillful in the style of drawing required by this method of engraving; and the process itself has, in several respects, been essentially changed and improved.

One of the methods devised by Mr. Moss to save labor in the production of pen drawings is this: The copy from which a drawing is to be made is photographed double the size of the plate required, on arrowroot paper, and then fixed and well washed, but not toned. Directly upon this print the drawing is made with a pen and india ink. When the outlines and all the important parts of the drawing are complete, a saturated solution of corrosive sublimate in alcohol is flowed over the drawing, which bleaches away the photographic color without at all injuring the lines in ink. The finishing touches are then added, when the drawing is ready to be reduced and engraved. Thus the tedious operations of sketching and tracing are obviated, and a degree of accuracy is secured which it would be difficult to obtain by any other means.

It should be observed here, however, that drawings are not required for all the engraving done by this company, since a large part of their work consists in the direct reproduction of woodcut, lithographic, and steel plate prints, either of the same size as the originals, or of reduced or enlarged sizes.

Up to the present time this company has engraved over 50,000 relief plates, measuring over 500,000 square inches; and it is estimated that, with about 60 employees, they are annually performing an amount of work that would require for its accomplishment at least 1,000 skillful wood engravers.

The view of the New York Post Office Building, on our first page, was engraved by this process from a pen drawing made by one of their draftsmen.

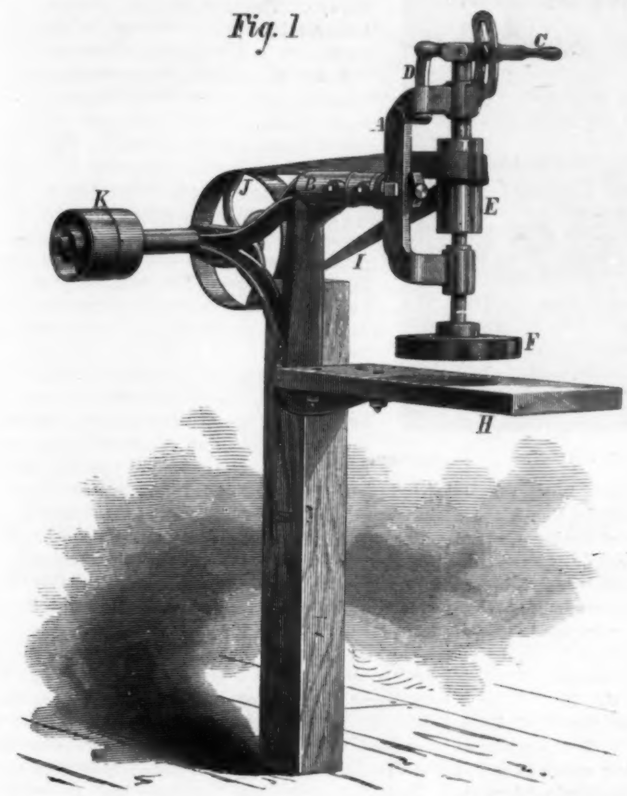
The English Polar Expedition.

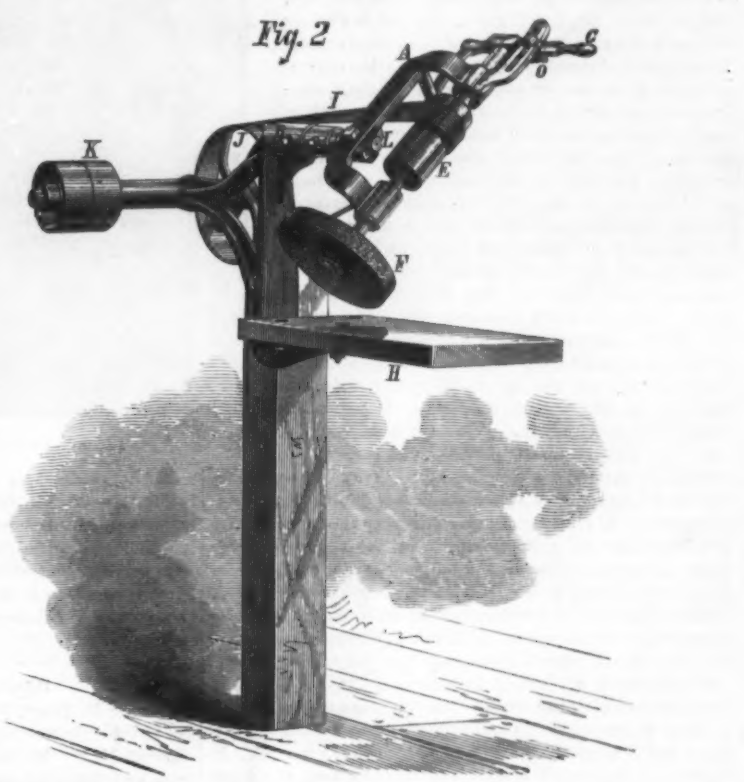
News has been received in England from the polar expedition, which sailed early in the summer. Both ships had arrived at Disco, Greenland, after a pleasant voyage, and preparations for pushing further north were in active progress. During next spring six sledges will start for the pole. One sledge will leave the party and return every week or so, transferring its surplus provisions to the others. When the exploring party is thus reduced to one sledge, that will push on alone and reach the pole by itself. If this is done satisfactorily, and all the surveys are completed, the expedition will be able to return to England during the autumn of 1876.

MR. PROCTOR, the celebrated English astronomer, who lectured in this country two years ago with so much success, is about to come again. He is an able and interesting speaker.

IMPROVED UNIVERSAL GRINDER.

The new emery grinder herewith illustrated is so constructed as to facilitate operations upon a large class of work done by machinists, stove fitters, and others, which cannot conveniently be performed upon horizontal machines. The principal feature of the device is the manner in which the wheel may be adjusted to work at any angle by simple mechanism, involving the use of no extra pulleys and belting.





SANFORD'S UNIVERSAL GRINDER.

Fig. 1 shows the grinder arranged for acting upon vertical work; in Fig. 2 the wheel is represented inclined.

The wheel shaft is mounted in bearings in the frame, A, which, by means of a set screw passing through a slot, is secured to a shank which enters a socket on the standard, B. The shank, by loosening the set screws which confine it in the socket, can be drawn out to tighten the belt which, acting on a pulley on the wheel mandrel, rotates the wheel, or it can be turned in the socket so as to set the latter at any angle. By means of the slot and set screw in the frame, the wheel can be adjusted nearer to or further from the table, as desired. The mandrel has several inches traverse in the frame, so that the pulley can be pressed down or lifted from the work by means of the simple lever arrangement at C. The lever may be set and held at any position by means of the nut shown, or the former may be counterweighted and operated by a treadle beneath the table.

In order to grind flat surfaces the wheel is lowered down to them. A conical wheel is used for grinding holes in stove plates, etc., an aperture being made in the table or an auxiliary platform thus provided being secured on top of the latter. For edging plates, the table can be made of sufficient size to sustain the whole weight of the plate, so that the attendant can bring a more even pressure on the wheel with little labor and without danger of injuring it. The wheel can be inclined so as to grind bevel edges with readiness; and by suitably formed grinders, moldings can easily be ground.

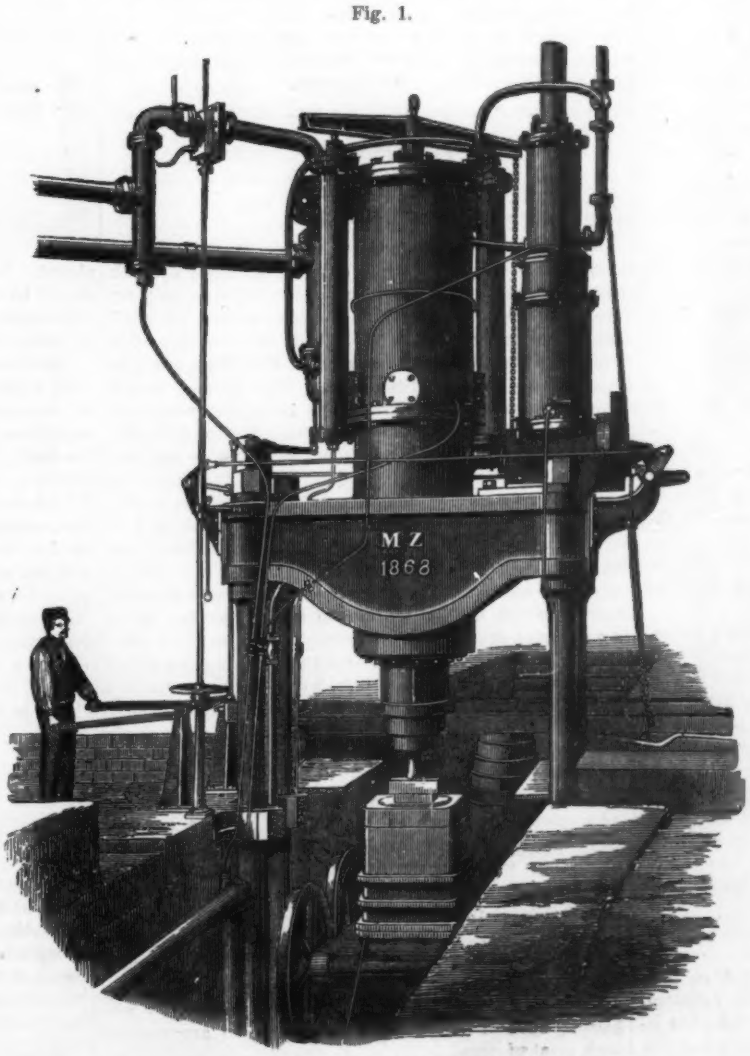
The machine is manufactured by the Tanite Company, of Stroudsburg, Pa., who may be addressed for further particulars.

COMPRESSED STEEL.

The manufacture of steel in large masses, although it has made vast strides during the past few years, is still characterized by many features requiring improvement, and especially among these may be mentioned the means by which homogeneity of structure is attempted to be secured. In ordinary practice steel is at present, to a large extent, cast into ingots which are honeycombed more or less by bubbles of gas distributed through the structure; and after solidification has taken place, it is attempted to displace these bubbles by the process of cogging, hammering, and rolling the material while in a heated state. During the earlier stages of this treatment, the steel is tender and requires to be dealt with carefully; but in proportion as its homogeneity increases, it becomes fit to resist more severe handling, the increase in its toughness, doubtless, to some extent, marking the expulsion of the gas bubbles and the welding together of their sides under the various compressing processes the material undergoes. It is undoubtedly true that this mode of treatment, when skillfully carried out as it is at our large works, gives excellent results, and produces a most valuable structural material; but it is equally true that it is far from being free from objections, while it is in some respects opposed to what may be theoretically considered the rational mode of procedure. In casting ingots it not unfrequently happens that the bubbles of gas are largely formed near the outer surface; and during the processes of reheating, these bubbles are apt to be opened up by the wasting of the surface, thus affording opportunities for the entrance of dirt and the formation of scale within the bubble cells, and, as a necessary consequence, interfering with the obtaining of a solid homogeneous mass. Under these circumstances, and inasmuch as it is at present scarcely possible to prevent the formation of the gas bubbles in the ingots during the process of casting, so long as the ordinary plan of teeming them in metal molds is adhered to, it is not surprising that the idea early suggested itself of getting the desired homogeneity by subjecting the metal to compression while in a liquid state, instead of allowing it to solidify before attempting to remove the bubbles. Such a mode of procedure is certainly a rational one, if we allow for the moment that the casting of perfectly solid ingots is at present unattainable in regular practice; and notwithstanding the practical difficulties attendant upon its being carried into effect, it is somewhat surprising that greater progress has not been made in its general application.

The plan of increasing the solidity of castings by compressing the metal while in a molten state is very far from being new; and as applied to copper, it has been in use in Manchester, England, for about twenty years past. As regards steel, the credit of suggesting its compression in the fluid state belongs, we believe, to Mr. Bessemer, who embodied the idea in one of his earlier patents; but in England it has in practice been worked out almost solely by Sir Joseph Whitworth, who for some years has been engaged in developing the system, and of whose success we shall have to speak presently. It was in France, however, we believe, that the process was first practically carried out on a large scale, Messrs. Révollier, Biétrix & Co., of St. Etienne, having adopted it in 1867, and having built steel works specially arranged for it in connection with furnaces for making steel by the Siemens-Martin process. According to the plans adopted by Messrs. Révollier & Co., the metal was run from the furnace into a ladle, which, by means of a turntable crane, was conveyed to the ingot molds, and the metal teemed into the latter. The molds were placed on an ingot carriage, and after filling they were run under a hy-

Fig. 1.



HYDRAULIC PRESS FOR COMPRESSING STEEL.

Fig. 2.

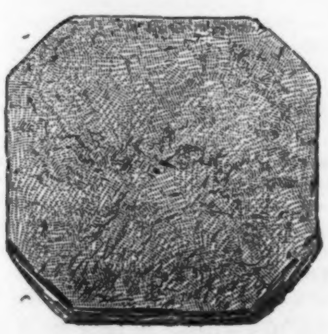


Fig. 3.

draulic press, and the metal subjected to compression until its temperature had fallen below that at which bubbles would be reformed. We do not know whether or nor Messrs. Révollier and Co. are still using the compressing process, nor what success has attended their latest experiments with it, but we know that during their earlier use of it they produced some very compact sound ingots, but also many failures. Not content with treating ingots, Messrs. Révollier and Co., also compressed —with varying success—more complicated castings, such as tyres, rings for guns, etc., but in dealing with such a manufacture they had to contend against the difficulty of running the metal at a lower temperature than was consistent with efficient compression, the initial temperature of the metal on leaving the furnace being reduced by its transfer by the ladle, etc. The result was that, to obtain the necessary liquidity in the molds, they were compelled to resort to the use of a metal containing a higher percentage of carbon and hence a lower melting point, but this metal again was unfitted for tyres, etc., on account of its hardness and brittleness, and hence failures. One great difficulty connected with the affair thus was that by the Siemens-Martin process it was not possible to deliver a mild steel into the ladle at a temperature so much above its melting point as to allow of it at length reaching the molds at a temperature suitable for undergoing compression. With the Bessemer process less difficulty is experienced in this way, the initial temperature being higher; but even where Bessemer steel is compressed, as at the Neu erg Works in Austria, it is found to be very important to keep up the temperature of the steel before compressing by heating the ingot molds before the steel is teemed, and by getting the molds under the press as promptly as possible after they have been filled.

The arrangements for compressing steel which have for some years been in use at the Neuberg Works were planned by Herr Von Stummer-Traunfels, and they have proved very successful, while they are also very simple. At Neuberg the steel from the converters is run into a receiver which is lifted by a powerful hydraulic crane on to a suitable carriage, and is then run on to a bridge over the press pit. At the bottom of this pit is a line of rails, so that the ingot molds mounted on carriages can be brought under the bridge to be filled with steel from the receiver and then promptly run under the press.

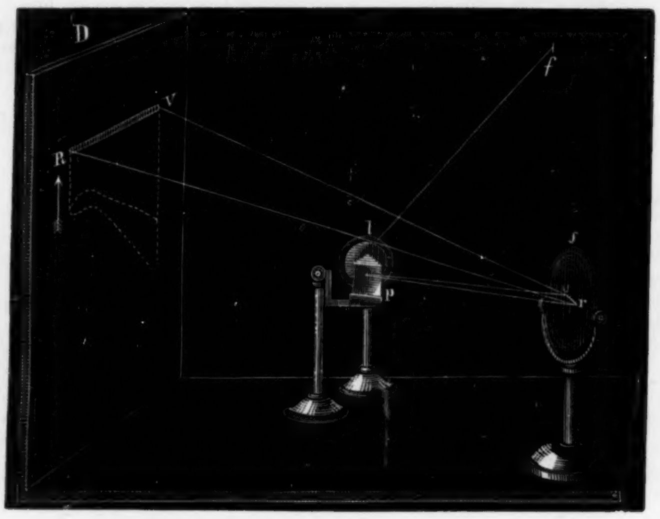
The ingot molds are, as usual, made for conical ingots, the section at the lower part being the ordinary one of an irregular octagon—or rather a square with the corners chamfered off—while at the upper part this section changes to circular, the upper portion of each mold being cylindrical, internally, for a length of about 6 inches, so as to form a guide for the press plunger. Externally the molds are circular, and they are turned slightly conical, while steel hoops are shrunk on them to enable them to resist the internal pressure. The conical form of the ingots would of course cause the fluid metal to exert an upward pressure, leading to separate each mold from its base, and to resist this the molds are furnished with strong flanges by which they can be secured to their bases. The mold bottoms, we may add, have a slight depression in the center, and in this is placed some fire clay on which the metal falls when teemed. This arrangement is employed to prevent the bottom from being injured by the pouring of the metal, it being important to keep the bottom sound, as it might otherwise give way under the action of the press.

Each ingot mold is mounted on its own carriage, the latter carrying it at such a hight that, when run under the press, the top plate of the carriage, on which the bottom of the mold rests, is clear of what we may term the anvil of the press, this being a strong casting fixed on firm foundations. The pressure imposed by the press varies from 400 to 700 tuns, and it is evident that the ingot carriages could never be made to resist such a pressure. To avoid the necessity for this, the lengths of rails on which a carriage rests when under the press are balanced so that, when they are merely loaded with the weight of the ingot, mold, and carriage, they are maintained on a level with the other rails; but when the press is brought to bear on the ingot, they descend and allow the top plate of the carriage to take a solid bearing on the anvil just mentioned. On the pressure being removed, the rails rise again and the carriage can then be run on to make room for another. The general arrangement of the press and press pit at Neuberg is shown by the annexed perspective view (Fig. 1.)

It should be mentioned that, when an ingot is being teemed in the press pit, a kind of funnel of wrought iron plate is placed in the mouth to prevent the latter from being injured by the molten metal. When the mold has been filled, this funnel is withdrawn, and a short plunger is inserted by means of tongs specially constructed for the purpose. The mold is then run under the press and subjected to pressure for from half a minute to one minute, it being found that this period is amply sufficient to insure the desired result. We may add that no difficulty is experienced from metal endeavoring to squeeze out around the plunger. Any metal so endeavoring to escape becomes at once so cooled as to solidify.

At the Vienna Exhibition of 1873, some excellent specimens of compressed steel were exhibited by the Neuberg Works, and amongst others the broken ingot from a photograph of which the annexed Fig. 3 has been prepared. This ingot was shown side by side with another broken ingot of the same steel, but uncompressed, an engraving prepared from a photograph of this second ingot being shown by Fig. 3.

If these two figures be compared, it will be seen that, whereas in the ingot represented by Fig. 3 there are a great number of bubbles near the outside—and in fact only protected by a thin skin, which might be injured in the reheating furnace—in the compressed ingot, shown by Fig. 2, there is one bubble only, and that at the center of the ingot, where it would most probably be thoroughly closed during the subsequent treatment of the ingot, or where, if it continued to exist, it could do little harm. Altogether we believe that the practice at Neuberg has been very successful.—*Engineering.*



RICCO'S EXPERIMENTS ON COLOR VISION.

Edward H. Tracy, C. E.

Edward H. Tracy, for several years past the Chief Engineer of the Croton Aqueduct of this city, died recently at Carmel, N. Y. He began his engineering career as a rod man, and from that humble position rose, by industrious attention to the duties assigned him, to be an assistant engineer under John B Jarvis, on the Chenango canal in this State. Subsequently, under the same chief, he assisted in the construction of the main line of our great aqueduct. He was afterwards engaged in several other important works, involving dock and railway construction. For the last five years he has been Chief Engineer of the Croton aqueduct.

Chloroform as a Preservative.

At a recent session of the British Pharmaceutical Society, Mr. J. B. Barnes stated that vegetable infusions may be preserved indefinitely by the addition of a minute quantity of chloroform. A mucilage of gum acacia and a malt infusion have been satisfactorily experimented upon, and the action of the chloroform appears to be to destroy the ferments. Mr. Barnes considers that the discovery may be applied to preserving solutions of citrate of ammonia, lemon juice, and other very alterable organic substances.

Correspondence.

Bee Culture.

To the Editor of the Scientific American:

I can confidently recommend bee culture, as well adapted to the sphere of women both in city and country. I speak from experience, having been engaged in this pursuit for over twelve years. In my first attempts at bee culture, I used the old fasioned box hive. These hives were readily constructed with little or no reference to giving a profit in surplus honey obtained from them. The losses in such hives, from various causes, especially in winter, were very great, and profits were small at the best; $10 to $12 profit from the sale of surplus honey from such hives in one season was considered an extraordinary yield. I have for several years used a hive of my own invention. It is constructed with special reference to securing a good yield of surplus honey, in the most convenient marketable form. My hive is so arranged and constructed that I am able to prevent or contrive the natural swarming of bees, and, when desired, to turn their whole force to storing surplus honey in the parent stock instead of swarming out, as they often do (to their great damage) under ordinary management. It is surprising to note how much more honey will be stored by a stock that does not swarm (yet has the same increase of bees) than by one that casts one or more swarms. I often obtain from 200 to 300 lbs. honey in small glass boxes from a hive in a season.

There is in my opinion no pursuit which offers greater inducements to women as bee culture. There are very many whose occupation confines them indoors nearly the whole time, excluding them from the air and sunshine, to the great injury of their health; while at the same time, after this great sacrifice, they barely succeed in obtaining a livelihood. To such, bee culture offers special inducements, such as health and a greater recompense for labor performed. I hope that ere long bee culture will receive from my sex the attention it deserves. I am acquainted with many who have lately commenced in the business who are meeting with great success.

West Gorham, Me. LIZZIE E. COTTON.

On Color Vision.

To the Editor of the Scientific American:

It is known that a certain length of time is necessary to the perception of light, and that the sensation in the eye does not disappear instantaneously with the disappearance of the luminous object. It is also the opinion of physiologists that the perceptions of the different simple colors require different times; as does likewise the persistence of the sensation remaining in the eye. The laws of these phenomena have not however been yet determined, and the following experiments, in my opinion, may serve that purpose;

A ray of sunlight, *f l*, is made to enter a dark room through a narrow vertical slot, *f*, by means of a *porte lumière*. It falls in an horizontal direction and meets a lens, *e*, a flint prism, P, which disperses it, and a mirror turning about on a horizontal axis, which reflects the rays in the same direction, above the prism, on a white screen placed at a convenient distance to obtain an horizontal spectrum, R V, well enough developed to exhibit at least the principal Fraunhofer lines. The whole apparatus should be so arranged that, when the mirror is slowly made to oscillate, the spectrum may be displaced parallel to itself.

If now the mirror is made to oscillate with a certain velocity, the spectrum will be seen to become curved in an unexpected manner, the extreme red and, still more, the violet remaining behind. On moving the mirror in the opposite direction, the spectrum oscillates with it, gliding and darting like a fish in the water. It will be noticed that the convexity of the anterior outline of the spectrum is in the yellow, which color precedes the others in the motion. On keeping the eye fixed on a point of the screen, it will be observed that the spectrum widens, and that the expansion is greatest in the violet and decreases towards the red.

The same result is obtained by projecting the spectrum directly upon the screw and observing its image in a mirror oscillating in front of it. With the proper diaphragms, which should be black and opaque, some colors may be intercepted, and only two allowed to pass in coincidence with the Fraunhofer lines; this renders comparisons easier.

From this experiment it follows that yellow is the color which most quickly affects the eye; then come orange, red and green, blue, indigo, violet. The persistence of vision is greatest in the violet and successively diminishes in the indigo, blue, green, yellow, orange and red.

This may be verified also with white light. In fact, on moving a watchglass reflecting the sun before a black back ground, and keeping the eye fixed on it, the little solar image will be seen converted into an elegant colored curve, in which the following colors are usually found: yellow, green, blue, indigo, violet.

Modena, Italy, August, 1875. A. RICCO.

PRACTICAL MECHANISM.

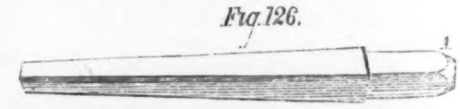
BY JOSHUA ROSE.

NUMBER XXXI.

REAMERS.

For reaming out taper holes, such as are employed to receive taper pins, the square reamer shown in Fig. 126 is employed.

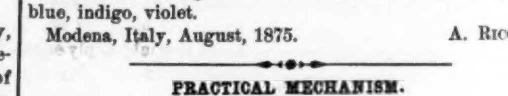
Fig. 126.



It is a piece of plain taper square steel. This tool should be dipped endwise in hardening, and tempered to a dark brown, leaving the square end, A (on which the wrench, by which the reamer is revolved, fits), of a blue color; because it is at times necessary to force it into its cut by striking it lightly with a hammer (a proceeding necessary with all reamers having appreciable taper upon them), which would break the edges of the square end off if they are left too hard. The edges are beveled off, as shown, to prevent the head of the square end bulging from being hammered. To sharpen it, the flat sides are ground, taking care to keep them straight and the thickness even on the two diameters, so that, the sides being straight and the reamer square, it will cut taper holes whose sides will be straight. If the reamer is not ground square, two only of the edges will be liable to cut, causing the reamer to wabble, and so impairing its cutting power and rendering it liable to break. This description of reamer is sometimes used to cut out holes in boiler plates which do not come fair after being punched.

The half round reamer shown in Fig. 127 will, however,

Fig. 127.



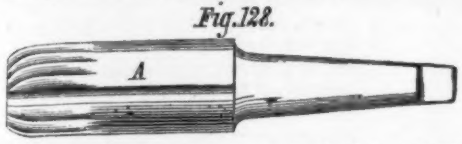
work much more steadily in holes which do not come fair, and will bore at all times more true, though it will not cut so rapidly as a square reamer, when employed to bore a straight hole into a taper one. The method of making this tool is to turn it up and cut away half the diameter, tempering as directed for the square reamer.

MACHINE REAMERS.

Reamers for use in a machine or lathe are of the form hown in Fig. 128. The serrations forming the cutting edges

are made at and near one end only, and do not run to the full length of the reamer. There are two and sometimes more flutes, A, provided to convey oil or water to the cutting edges and receive the cuttings. This description of reamer is employed to take out a very light cut only, and must run very true in the machine. Fewer cutting edges and flutes, running the entire length of the reamer, may be employed for heavier duty or for brass work, being much better qualified to

Fig. 128.



carry off the cuttings; but in that case, the backing off of the teeth should be performed at a distance from the end of the reamer equal to its diameter, so that no cutting duty will be performed by the teeth beyond that distance; otherwise, from spring, play in the spindle of the machine, or from other causes, the reamer will cut the holes of a diameter larger at the end at which it entered. All reamers should be well supplied with oil for heavy cuts on steel or wrought iron, and soapy water for fine finishing cuts on those metals; oil may also be used for brass work, providing the cut is very light and the cuttings can find very free egress.

SHELL REAMERS

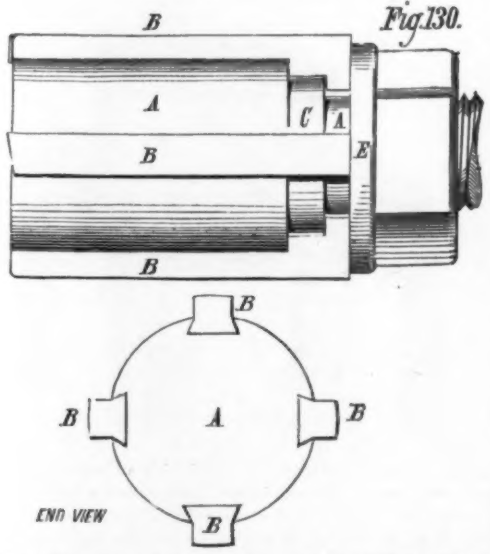
Shell reamers, such as shown in Fig. 129, are excellent tools for sizing purposes, that is, for taking a very light cut intended merely to smooth out the hole, and insure correctness in its bore or size. They are short reamers, having a conical hole running through the center which is fitted to a cone mandrel as a stock; thus three or four different sizes of reamers may fit to one stock. Through such stocks there should always be bored a hole into which a pin may be driven, projecting at each side of the stock to nearly the diameter of the shell reamer, in which there should, on each side, be filed a semicircular groove to receive the pin. Thus the reamer will be prevented from slipping upon the mandrel, as it is otherwise very apt to do.

Fig. 129.

Many attempts have been made to produce adjustable reamers having movable cutters, so that the size of the reamer may be varied by a change of cutters, and economy in sharpening and renewing is attained. None of these efforts, however, have met with such success as to cause their universal application. Of course such a tool is only applicable to sizes above an inch in diameter, because the division of a reamer of less than that size into two or more pieces weakens it so that it would not bear the necessary strain.

The best form of adjustable reamer of which I have any knowledge is that of one I designed and made for use on cast iron work, though I have no doubt it would apply equally well to work in brass, wrought iron, and steel. It proved a very serviceable tool, and is easily made, as a reference to Fig. 130 will show. A represents the stock, and D the cut-

Fig. 130.



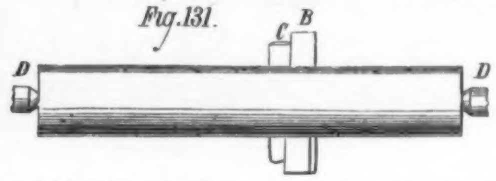
ters, C being a regulating washer, and D and E the tightening nut and washer. Each of the cutters, B, fits into a dovetail and taper groove in the stock, the shallow end of the groove being at the cutting end; so that, if the regulating washer, C, is reduced in width, the cutters will slide forward and enlarge in diameter. The washer, C, is thus a means of adjusting the diameter of the cutters; and when the same is once adjusted, the nut, D, will lock it always to that precise diameter If, therefore, several sets of cutters of different hights are fitted to one stock, and turned up, while in the stock, to the requisite diameter, with the washer, C, in its place, we have a set of standard cutters which may always be placed in position and locked up by the nut, D, without measurement, since their sizes cannot vary. By providing another washer, very slightly thicker than the standard, the reamer will, in the case of each set of cutters, bore a hole to a driving fit, while a washer a trifle thinner will cause the cutters to bore a hole of an easily working fit. Thus the sizes of the cutters are regulated by the washer, C, and not by measurement by the workman; they are therefore at all times positive and equal. The cutters are backed off on the ends only, their tops being merely lightly drawfiled after being turned up, or they may be left one thirty-second of an inch too large, and ground off after hardening, by the grinding process already described. The cutters should be forged of the best cast steel, and tempered to a straw color.

BORING BARS.

The boring bar is one of the most important tools to be found in a machine shop, because the work it has to perform requires to be very accurately done; and since it is a somewhat expensive tool to make, and occupies a large amount of shop room, it is necessary to make one size of boring bar answer for as many sizes of hole as possible, which end can only be attained by making it thoroughly stiff and rigid. To this end, a large amount of bearing and close fitting, using cast iron as the material, are necessary, because cast iron does not spring or deflect so easily as wrought iron; but the centers into which the lathe centers fit are, if of cast iron, very liable to cut and shift their position, thus throwing the bar out of true. It is, therefore, always preferable to bore and tap the ends of such bars, and to screw in a wrought iron plug, taking care to screw it in very tightly, so that it shall not at any time become loose. The centers should be well drilled and of a comparatively large size, so as to have surface enough to suffer little from wear, and to well sustain the weight of the bar. The end surface surrounding the centers should be turned off quite true to keep the latter from wearing away from the high side, as they would do were one side higher than the other.

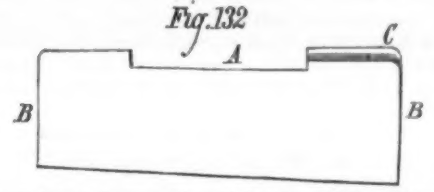
The common form of the smaller sizes of boring bar is that shown in Fig. 131, A A being the bar, D D the lathe cen-

Fig. 131.



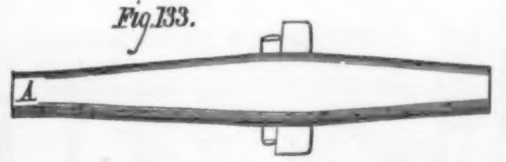
ters, B the cutter passing through a slot or keyway in the bar, and C a key tapered (as is also the back edge of the cutter) to wedge or fasten the cutter to the bar. It is obvious that, if the cutter is turned up in the bar, and is of the exact size of the hole to be bored, it will require to stand true in the bar, and will therefore be able to cut on both ends, in which case the work may be fed up to it twice as fast as though only one edge were performing duty. To facilitate setting the cutter quite true, a flat and slightly taper surface should be filed on the bar at each end of the keyway, and the cutter should have a recess filed in it as shown in Fig. 132,

Fig. 132



the recess being shown at A, and the edges, B B, forming the diameter of the cutters. The backing off is shown at C, from which it will be observed that the cutting duty is performed by the edge, C, and not along the edge, B, further than is shown by the backing off. The recess must be made taper, and to fit closely to the flat places filed on the bar. Such a cutter, if required to be adjustable, must not be provided with the recess, A, but must be left plain, so that it may be made to extend out on one side of the bar to cut any requisite size of bore; it is far preferable, however, to employ the recess and have a sufficient number of cutters to suit any size of hole, since, as already stated (there being in that case two cutting edges performing duty), the work may be fed up twice as fast as in the former case, in which only one cutting edge operates. This description of bar may be provided with several slots or keyways in its length, to facilitate facing off the ends of work which requires it. Since the work is fed to the cutter, it is obvious that the bar must be at least twice the length of the work, because the work is all on one side of the cutter at the commencement, and all on the other side at the conclusion of the boring operation. The excessive length of bar, thus rendered necessary, is the principal objection to this form of boring bar, because of its liability to spring. There should always be a keyway, slot, or cutter way in the exact center of the length of the bar, so as to enable it to bore a hole as long as possible in proportion to the length of the boring bar, and a keyway or cutter way at each end of the bar, for use in facing off. If, however, a boring bar is to be used for a job which does not require to be faced off at the ends, the keyway should be placed in such a position in the length of the bar as will best accommodate the work, and should then be made tapering in diameter from the keyway to the ends, as shown in Fig. 133, the end, A,

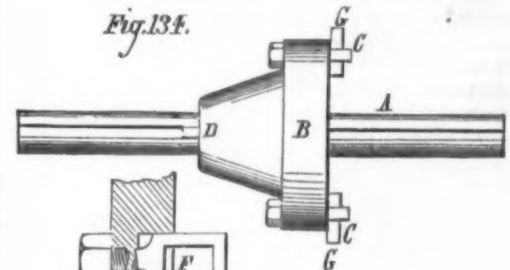
Fig. 133.



being made parallel to receive the driving clamp. A lug, however, by which to drive the bar, is sometimes cast at A. This form of bar is stronger in proportion to its weight, and therefore less liable to spring from the cut or to deflect than is a parallel bar. The deflection of a bar, the length of which is excessive in proportion to its diameter, is sufficient to cause it to bore a hole of larger diameter in the center of its length than at the ends, providing that the cutter is not recessed and does not cut on both sides, that is to say: when the cutter has the edges, B B, in Fig. 132, bearing against the diameter of the hole, they serve to steady the bar and prevent it from either springing away from the cut, or from deflecting in consequence of its own weight. The question of spring affects all boring bars; but in those which are used vertically, the deflection is of course obviated.

Here it may be mentioned that no machine using a boring bar should be allowed to stop while the finishing cut is being taken, for the following reasons: The friction, due to the severance of the metal being cut, causes it to heat to a slight degree, and to therefore expand to an appreciable extent; so that, when the cutter makes its first revolution, it is operating upon metal at its normal temperature, but the heat created has expanded the bore of the work, and hence the cut taken by the second revolution of the cutter will be slightly less in diameter. This heating and expanding process continues as the cutting proceeds, so that if (after the cutter has made any number of revolutions) the bar is stopped and the cylinder or other work being bored becomes cool, when the cutter makes the next revolution it will be operating upon the bore unexpanded by the heat, and hence will cut deeper into the metal until, the metal being reheated by the cut during the revolution, the boring proceeds upon expanded metal as before the stoppage; thus arresting the continuous progress of the cutter will have caused the cutting of a groove in the bore. Boring bars of this description, for use in bores of a large diameter, are made with a head of increased diameter, as shown in Fig. 134, A A representing a bar turned

Fig. 134.



true from end to end, and having a keyway cut along its entire length, and B the cutter head, held in upon any point in the length of the bar by being keyed to it at D. A number of cutting tools are carried by the head, B, and fastened to it by the strap, as shown at C, and enlarged at E, F being the slot to receive the tool. It will be observed that there is in the head a recess to receive the clamp, which recess should be made deep enough to leave a clearance between it and the shoulder of the clamp, to accommodate any variation in the thickness of the cutters. Several cutters may be provided to the head, so that the work may be fed up rapidly; in such case, however, great exactitude is required in setting them, because there is no practical method of making them with a recess to insure their even projection from the bar, since the cutters are narrow, and generally cut across the whole end face, G, so that each grinding affects their distance from the bar, and hence the size they bore.

A rude form of the head, B, may be made by simply cutting a slot or slots across it, and fastening the tool or tools therein, by means of wedges and packing pieces if necessary. The only advantage possessed by this bar is that it will bore a round hole, even though the bar may run out of true, by reason of either or both of the centers being misplaced, or even though the bar itself may have become bent in its length. In addition, however, to its disadvantage as to excessive length, it possesses the further one that, unless a line drawn from the two centers upon which it revolves is parallel both perpendicularly and horizontally to the lathe bed, the hole bored will be oval and not round; or if the bar is not parallel horizontally with the shears, the hole will be widest perpendicularly, and *vice versâ*. To remedy these defects, we have the boring bar with the feeding head, which is similar to that shown in Fig. 134, save that the work remains stationary while the cutters are fed to the work by operating the head, B, along the bar, which is accomplished as follows: Either along the keyway or groove, or else through and along the center of the boring bar, there is provided a feeding screw, passing through a nut which is attached to the sliding head, B. As the bar revolves upon its axis, the screw is, by means of suitable gearing, caused to revolve upon its own axis, as well as around the axis of the bar, thus winding the head along the length of the bar, and thus feeding it to the cut. If the screw runs along the center of the bar, it is usually operated by gear wheels, the movement of the feed being continuous at all parts of the revolution; but if the screw is contained in a groove cut in the circumference of the bar, a common star feed may be attached to the end of the bar, in which case the feed for the whole revolution is given to the sliding head during that portion only of the revolution in which the outer arm of the star is moved by the projecting bolt or arm which operates it. From these directions, it will be readily perceived that a bar of the latter form, but having the screw in its center, is the most preferable. Care must be taken, however, to keep these bars running quite true; for should either center run out of true, the hole bored will be larger in diameter at that end; while on the other hand, should the bar become bent so as to run out of true in the middle of its length, the hole bored will be large in the middle if the work was chucked in the middle of the length of the bar; and otherwise, it will be larger at one end.

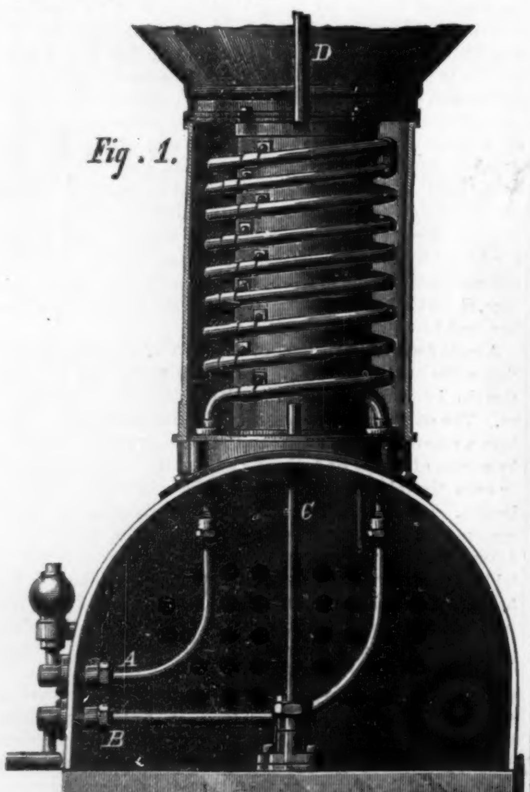
NEW LOCOMOTIVE FEED WATER HEATER.

The advantages arising from the use of hot instead of cold water, in feeding steam boilers, whether stationary or locomotive, are too apparent to need rehearsal, more especially where the hot water for that purpose is produced by utilizing heat which would otherwise be wasted, the most important results being the saving of fuel, prevention of the contraction and expansion of flues and flue plates, and the ability to maintain steam.

In the adaptation of a locomotive engine to heat its own feed water, four difficulties have always stood in the way; first, to use the waste or exhaust steam without lessening the draft of the chimney; second, to avoid the cumbersome and complicated devices necessary for heating the water in bulk; third, to prevent obstructing the smoke arch; and fourth, to so construct and arrange all parts of the apparatus as to obviate derangement and leakage, either from contraction and expansion, or the jarring of the engine. These difficulties have been overcome by the device illustrated in the annexed engravings.

In Fig. 1, which is a detailed sectional view, it will be seen that an insulated steam chamber is constructed about the smoke stack. Into this chamber leads the feed water pipe, A which is coiled around the stack, conducting the water to the top of the compartment and then down and out to the boiler, at B. The exhaust is divided, a branch pipe, C, being employed to conduct a part of the steam into the chamber for heating the feed water in the coiled tube, while the main exhaust discharges up the smoke pipe to promote the draft of the engine in the usual manner. A small eduction pipe, D, is provided near the top of the chamber, through which the waste steam passes, and there is also a drip pipe near the bottom of the chamber, for carrying off the water of condensation. There is a joint in the stack below the bonnet, to afford easy access to the top of the heater, and a second joint for like purpose at the bottom of the chamber

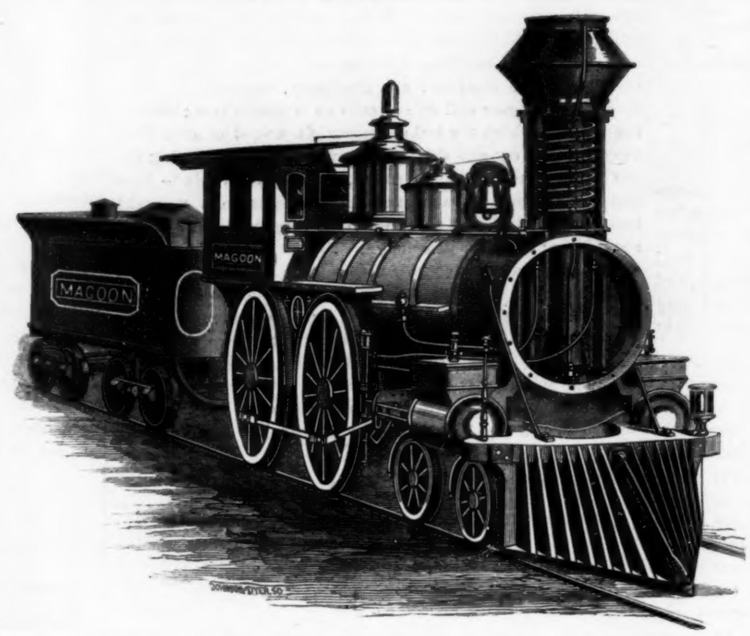
An improved arrangement of the water pipes which the company is now making, is to remove them from the interior of the smoke chamber and place them outside, where they pass through suitable saddles.



MAGOON'S LOCOMOTIVE FEED WATER HEATER.

According to certificates and testimonials submitted, it appears that the saving of coal attributed to this device, on one locomotive (the Saxon, of the Boston and Maine railroad), was about three quarters of a tun per day for four months in succession. On a small engine on the same road, the saving was nearly half a tun per day. The most recent tests show an economy of over 35 per cent of the fuel used, the value of which must evidently reach a very large aggregate in the course of a year, in the case of a road employing many locomotives. Fig. 2 gives a slightly different arrangement of the feed water pipes. The actual economy in fuel resulting from the use of this invention, coincides with the calculated economy of feed water heaters in general, as given in the SCIENTIFIC AMERICAN of November 7 last.

No difficulty is experienced in making the coiled pipe to withstand any necessary pressure, as proven in the cases before alluded to and in others. The coil is made at least one sixth part larger in interior diameter than the pump plungers; and the check valve is slightly larger than the coil in order to give free passage for the water into the boiler. If constructed in this way, and properly stayed to the saddle and smoke stack, the device will be as permanent as any other part of the machine. Proper allowance is made for contraction and expansion of the stays and coil. We have obtained the foregoing particulars as to the construction from the Magoon Heater Company, 54 Sears Building, Boston, Mass., who are the manufacturers of the invention.



MAGOON'S LOCOMOTIVE FEED WATER HEATER.

New Aniline Violet.

A new pigment called violet gentiana, for producing the aniline colors of Martins and Meldensohn of Berlin much cheaper than the other violets in use, has for some time been on sale. A series of trials are said to have given the following results: When dissolved in thirty times its weight of hot water, brought quickly to the boiling point, and kept boiling for five minutes, and then passed through a sieve, it leaves little residue.

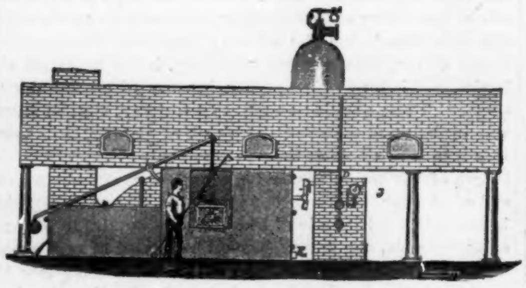
To dye 25 lbs. of woolen yarn, take 1 lb. of tartaric acid and a corresponding quantity of coloring matter; boil and skim the mixture. Pass the yarn three times through the dye, and it will assume a very uniform tint. The color obtained is as solid and as brilliant as that obtained from dearer violets.

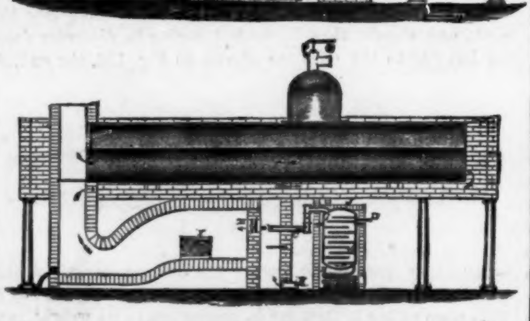
The Patent One-Tailed Shirt.

An illustration of the absurdity of some of the official examinations made at the Patent Office is seen in the patent granted to J. H. Meyers for an alleged improvement in shirts. It consists of a common shirt with the sleeves and the back tail omitted. These parts, says the patentee in his specification, any person can readily supply; but the bosom, neck band, yoke and front tail, he thinks require more trouble to make; so he sews these together, and the Patent Office grants him a patent therefor "as a new article of manufacture." But there is nothing new about it. It is simply an unfinished garment, and an old pattern at that. With equal propriety the Patent Office might grant a patent for a shoe, as a new article, which consisted merely of the strings and the upper, with the sole left out. Verily, the Patent Office is a queer institution.

FURNACE WORKING WITH PETROLEUM.

Professor Henry Wurtz was recently called on to examine

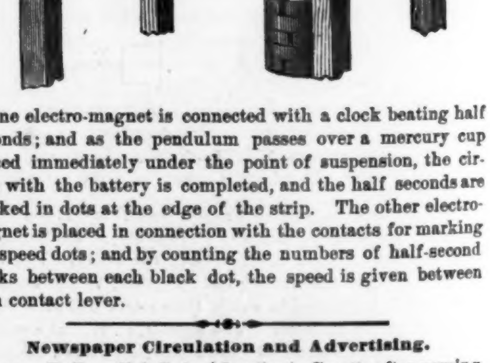




and report upon the value of the system of Dr. C. J. Eames of obtaining from crude petroleum simultaneously both the heat and the power needed for metallurgical operations upon iron. We extract the following from his report The upper engraving shows an ordinary reheating furnace for iron, such as the experiments were made with; but the form is by no means the best for developing the full merits of the new system, but answers tolerably well for the experiments made. This is an external, and the lower a sectional, view. In the latter, A B J D indicate the Eames vapor generator, called simply the generator, the main feature of the new apparatus and process. A is a cast iron vessel, with horizontal shelves projecting alternately from opposite sides, over which shelves the oil, entering at D, at the average rate—for this one furnace, when heating 3,000 lbs. of iron at a charge, and making steam for the rolls besides—of 30 gallons or 200 lbs., as a maximum per hour, flows downward in a thin layer, dripping from shelf to shelf. It thus meets a slow opposing current of steam heated to incandescence, and kept at a pressure of about 10 lbs. per inch, and which passes upwards from the superheating coil, B, inclosing the fire. Every trace of oil is taken up and swept on to a mixing chamber which occupies the former fire space, where it meets the air blast entering at the point, E (the former ash pit). It will be observed that the former bridge wall of the furnace is built up solid to the crown, except the space at H G, called the combustion chamber, an important and essential part of the inventions. This consists simply of a cellular tier of firebricks placed on end, and extending all across over the old bridge wall. Within these cells the combustion begins, and it is found that, if this combustion space has a horizontal thickness of more than 18 inches, the firebricks fuse down. I is intended to represent one of the piles of scrap iron, with its top and bottom covers, of which, however, six, averaging 500 lbs., each, are introduced at a charge, in regular working. The course of the flame under, and back through, one of the flues of the boiler above, and thence into the stack, is sufficiently indicated by the arrows.

ELECTRICAL SPEED RECORDER.

The accompanying engraving represents an electrical speed recorder, constructed by Mr. W. Groves, of London, England. The instrument consists of a train of clockwork, driven by a weight, and employed to move the strip of paper upon which the speeds are recorded. Two electro-magnets are attached to the frame, and opposite their poles an arbor is pivoted, carrying a soft iron armature: and in connection with each armature is a bent and pointed lever, the ends of which pass through holes in the ink trough when the armature is attached. These points carry on them sufficient ink to make a dot on the paper. The trough is divided into two compartments, one containing red and the other black ink. The former is used to mark half seconds, and the latter to record the speed. The holes in the trough are made so small that capillary attraction prevents the ink from flowing through.



One electro-magnet is connected with a clock beating half seconds; and as the pendulum passes over a mercury cup placed immediately under the point of suspension, the circuit with the battery is completed, and the half seconds are marked in dots at the edge of the strip. The other electromagnet is placed in connection with the contacts for marking the speed dots; and by counting the numbers of half-second marks between each black dot, the speed is given between each contact lever.

Newspaper Circulation and Advertising.

George P. Rowell & Co.'s *Advertiser's Gazette*, after naming some papers which have reduced their rates for advertising, adds: "There are many large weeklies which are at present demanding for advertising more than double the price to which their circulation entitles them."

We have no doubt but that that is so. There has been a great falling off in the subscription list or a great many papers; but it is not so with others. The SCIENTIFIC AMERICAN has several thousand more circulation now than it had last year at this time; and it is continually increasing, but its rates for advertising have not been advanced. For machinery, tools, patents, and every want of contractors, civil and mechanical engineers, surveyors, artisans, manufacturers, and all similar industries, this paper is unequalled as an advertising medium

SWANS.

SWANS.

The nest of the swan, says Mr. H. R. Robertson, is a thick and rather untidy mass of sticks, reeds, flags, and rushes. From the fact of the birds naturally preferring the most secluded spots by the water, we more often find a swan's nest on a small island than on either bank of the river; the osier beds are perhaps the localities most favored by them. The eggs are six or eight in number, and are hatched in five or six weeks. The young birds are termed cygnets, and are covered with a grayish brown plumage, which is not entirely lost till the beginning of the third year. Though the swan is, in general, very gentle and inoffensive, the male bird will defend the nest with great courage, and advance to the onset with ruffled pinions and every demonstration of anger; nor is it, from its muscular powers, an antagonist to be despised. While the cygnets are very young, one or two of them will sometimes climb up on to their mother's back, who never sails along more proudly than when her dusky brood is thus cradled between her snowy wings.

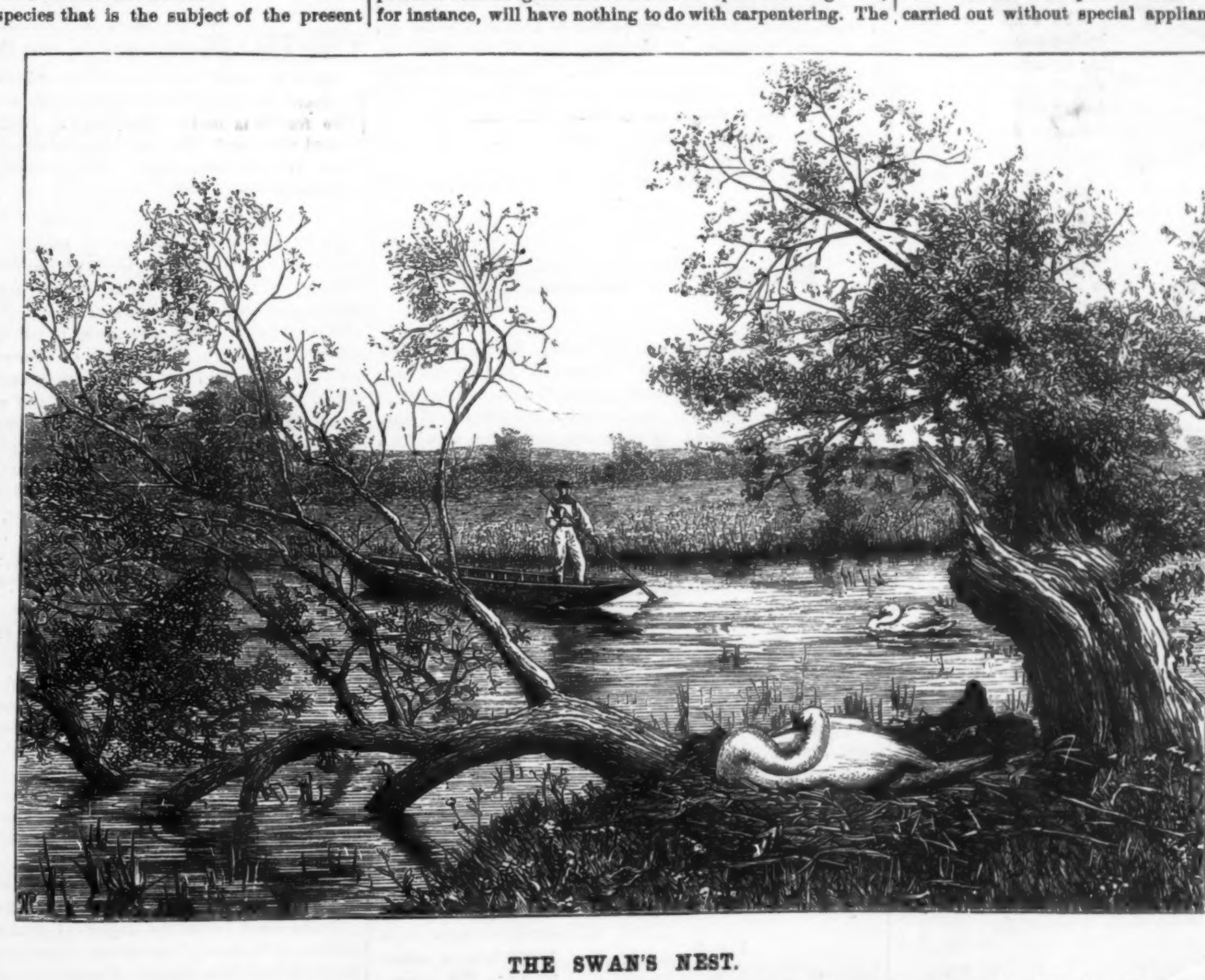
Swans do not breed until they are several years old, and they mate strictly in pairs; the technical terms for the male and female are cob and pen. The cob, or male, has a thicker neck and a larger berry at the base of the bill than the pen, or female; he also swims more buoyantly, from having more volume of lungs. Maturity in both cob and pen is shown by the size of the berry and the depth of the orange color of the bill.

Taking swan's eggs from the nest, and certain other birds', was an offence severely with in England in old times. We find, in an act of Henry VII., that "no manner of person, of what condition or degree he bee, take or cause to be taken, be it upon his owne ground or any other mans, the egges of any fawcon, goshawk, laners, or swans, out of the nest, upon paine of imprisonment of a yere and a day, and fine at the kings wil, the one halfe thereof to the king and the other half unto the owner of the ground where the egges were so taken."

The swan feeds on aquatic weeds, the spawn of fish, and coarse grass growing by the sides of the water; it is furnished with a gizzard of extraordinary muscular power, which enables it to grind the weeds, however fibrous, to a pulp.

All writers on the subject agree that the swan is very long lived, some saying that it attains thirty years, while others assert that it sometimes survives a century.

"Man comes and tills the earth and lies beneath,
And after many a summer dies the swan."



THE SWAN'S NEST.

The particular species that is the subject of the present article is often semi-domesticated on lakes and ornamental waters, and is known as the tame or mute swan—*cygnus olor* of the ornithologists. It is said not to have been originally a native of the British islands, but is found in the eastern portions of Europe and the adjacent parts of Asia, where inland seas, vast lakes, and extensive morasses afford it a congenial home. In Siberia and some parts of Russia it is common, and it abounds on the shores of the Caspian Sea. It is doubtful when this most elegant bird was introduced into Great Britain, where it is such a universal favorite.

Wild swans may be often observed flying in a wedge-like form high in air, but they very rarely settle. This species, *cygnus ferus*, is neither so large nor so graceful as the tame swan.

For its value as an article of food, the swan is now almost entirely disregarded. Two or three are still fattened every Christmas time for Windsor Castle, where, in accordance with old usage, they make their regular appearance on the royal table. On only one occasion have we ourselves ever had the opportunity of proving the taste of our ancestors in the matter, and we are inclined to class the royal bird along with the royal fish, the sturgeon, as really inferior in flavor to many a plebeian dish. In color the flesh is extremely dark, and if we may speak from our solitary experience, we should describe it as somewhat dry and decidedly coarse in fiber; the bird in question was a young one, which had been carefully fattened, and kept till tender after being killed.

Wilful Ignorance of Common Things.

A little knowledge may be a dangerous thing, but a knowledge of little things is useful and therefore desirable. At the recent meeting of St. Saviour's District Board of Works, Dr. Albert J. Bernays submitted his report as public analyst. In the course of his remarks he described the results of his various analyses of food, chiefly of milk, the adulteration of which he believed was on the increase. He had also analyzed several samples of bread and butter, and had generally found them to be pure. In conclusion, he suggested that a museum of common things should be attached to every board school, so that the rising generation might acquire a knowledge of them, and the uses for which they are intended. Dr. Bernays deserves great credit for his admirable suggestion. It is wonderful how ignorant the commoner class of people are of things in every day use. For them not to be able to distinguish between a hawk and a hernshaw is excusable perhaps. But there are many who hardly know a mangold or a swede when they see it, who would fancy oilcake was a larger and perhaps a coarser kind of toffee, and who might be at a loss to tell a field of potatoes from a field of turnips. Again, there are those who, following some mechanical occupation, are content with the knowledge of that only, and prefer to remain ignorant of kindred occupations. A glazier, for instance, will have nothing to do with carpentering. The carpenter will tell you that the setting of a grate or bell-hanging is no business of his. The ironmonger is utterly careless about bricklaying, and the bricklayer returns the compliment. Each of those classes of mechanics advisedly remains or professes to remain in utter darkness as to the occupations of his fellows. True, a jack of all trades may be master of none, but there is no earthly reason why a mechanic should not be able to adapt his manual talents to more than one kind of work. The hand that can use a saw or plane, that can adjust beams and joists with the greatest nicety, is surely able to fix a grate, to hang a bell, to use spade and trowel, pick or level. The ironmonger must know something of brickwork, and the bellhanger of ironmongery. We are aware that the selfish spirit of trades unionism steps in here, and lays it down imperatively, *ne sutor ultra crepidam*. As the cobbler to his last, so the carpenter to his bench, the blacksmith to his forge, and so on through the category of mechanical workmen. But what an advantage it is to men to be what is generally called handy! As the all-round cricketer of fair average merit is more successful in the long run than the brilliant bat who is a poor field and an indifferent bowler, or the unerring bowler who neither bats well nor fields well, so the workman, who is a fair average carpenter, bricklayer, ironmonger, bellhanger, etc., may be more useful generally than the one who purposely confines his knowledge to one particular class of work. Put such a generally useful man down in the backwoods of Canada and we think the point of our case will be illustrated at once. Now if, in these museums which Dr. Bernays proposes to attach to board schools —why not to all schools?—there were specimens not only of comestibles, but of ordinary implements in everyday use; if, further, one or more paid instructors were attached to every such museum—such instructors would very soon become self-supporting—whose business it was to teach our rising generation the uses of these implements and the characteristic features of this or that food, it is no great evidence of wisdom to foretel that the said rising generation of Englishmen would be infinitely less ignorant and infinitely more handy and self-reliant than is the present. The man who tells you he cannot do this or that kind of work, and does not try to do it, is little short of a fool.— *Land and Water.*

Preservation of Wood Telegraph Poles.

Tar is employed, but it is necessary to apply it hot, and to avoid boiling it too long, lest it should lose the essential oils, which alone aid it to penetrate the wood. The latter should be first considerably heated to remove humidity and to open the pores; the tar is then applied, and, penetrating it, forms a strongly resisting covering. One thick coating produces a very bad effect; it is necessary to apply several light coats, a process somewhat difficult and requiring practice. If this mode is not adopted, a covering will be simply laid over the surface of the wood, which will be separated by damp, and, being brittle, will be easily broken away. The fungus filaments would then be free to attack the wood, and destruction would take place almost as rapidly as if the tar had not been laid on. The process above described can hardly be carried out without special appliances. The best mode is, first to heat the wood, then to immerse in a bath of tar the whole of that portion to be placed in the ground, and to leave it in the bath for 24 hours at least. The tar should be heated to boiling point.

Carbonization has also been applied with very good results. By raising the wood to a sufficient temperature, coagulation takes place, and any dangerous spores are consumed. But it is better to burn the wood imperfectly than to carbonize it to such an extent as is usually done. When the burnt portion is too thick, it loses its cohesion, and becomes broken during transport, so that the wood is again exposed to the air. It is better to obtain a thin and uniform covering by soaking the wood in acidulated water (five parts of water and one of sulphuric acid) and heating it lightly without exposing it to the flames. The more acid is added to the water, the less heating will be required, and it is preferable to obtain a thoroughly solid coating, by heating it for a longer time, at a less elevated temperature. This method is all the more worthy of attention because the sulphuric acid penetrates the wood to a certain depth, and partially preserves it from the attacks of the fungus.

PAINT skins, boiled with linseed oil, and having, while hot, a quantity of sand and lime stirred in until the requisite thickness is obtained, make a durable cement for leaky roofs.

MAGNETISM.

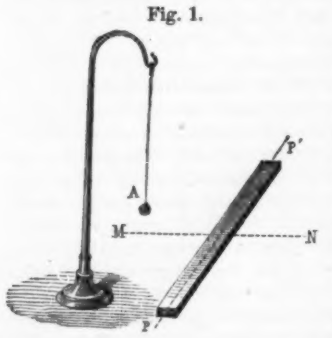
In ordinary observation, magnetism is scarcely known except as existing in iron, and especially in steel, and as related in some obscure manner to the earth. But there is reason to believe that it is one of the most extensively diffused agents in Nature. It can be traced not only in iron, but also in every substance into which iron enters into composition. It is found in nickel, cobalt, chromium, and other substances, and even in some gases. Wherever a galvanic current exists in Nature, whether produced by chemical action, or appearing in the thermo-electric form as originating from the effects of heat at the place of union of different substances, magnetic effects can be elicited. On the larger scale, it is certain that the whole earth acts as a combination of magnets, and there is reason to think that the sun and the moon also act as magnets.

The laws of magnetic force, however, have been experimentally examined with philosophical accuracy, only in their connection with iron and steel, and, by inferences bearing considerable probability, in the influences exerted by the earth as a whole. The ferruginous minerals of the formula Fe_3O_4 possess the property of attracting iron and its filings, and are called natural magnets or lodestones.

Experience has demonstrated that the attractive action of magnets takes place in a vacuum and through all bodies, whether gaseous, liquid, or solid, when they are not themselves magnetic. All the properties of natural magnets may be permanently communicated to needles or to bars of steel properly tempered, which are then said to be magnetized, and take the name of artificial magnets.

If a small iron ball, A (Fig. 1), be suspended by a flexible thread, and successively presented to various points of the surface of a magnetized bar, although it may be kept at the same distance from the bar in every case, the deviation of the ball, A, will undergo considerable variation as it is changed from point to point. In the section, M N, perpendicular to the middle of the axis of the figure, P P', the attractive action is zero; in either direction from this position the pendulum is more deviated from the vertical as it is placed nearer to the ends of the bar.

Fig. 1.



The same fact may be demonstrated by rolling a magnetized bar in iron filings (Fig. 2); or better still, (Fig. 3), by covering a magnet with a thin cardboard which is lightly tapped with the fingers, while iron filings are scattered over its surface from a sieve. The directions which the lines of filings take prove that the middle section, M N, produces no action whatever, and that, towards the ends of the bar, in the axis of the figure there are two points, P P', which are centers of the strongest attraction.

Fig. 2

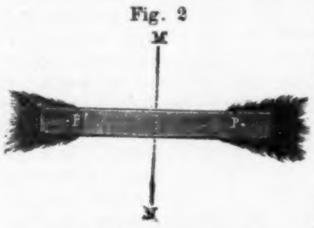
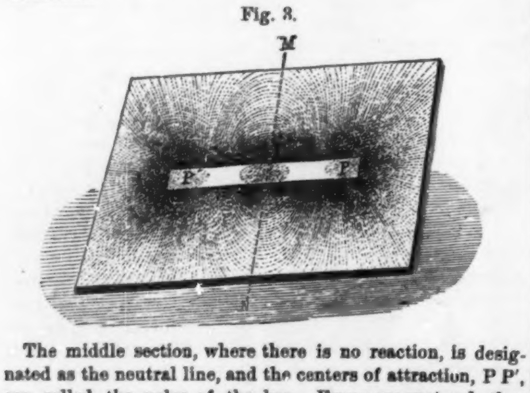


Fig. 3.



The middle section, where there is no reaction, is designated as the neutral line, and the centers of attraction, P P', are called the poles of the bar. Every magnet, whether natural or artificial, possesses at least two poles. When the magnetization is regular, the magnet has but two poles, which are situated in the axis of the figure and near its ends. When the minerals containing iron, or the steel bars, have more than two poles, they are said to be irregularly magnetized, or that they have consequent points. In every case, however, two consecutive poles are separated by a neutral line or a line in which there is no action.

If a magnetized bar is suspended horizontally by means of the stirrup, C (Fig. 4), made of paper or copper, and supported by a thread without torsion, the whole system partakes of a movement set up by the magnetic influence of the earth. After a certain number of oscillations, the bar becomes quiet in such a position that its axis is directed from north to south. If the same bar is used several times in succession, it always comes to rest in the same position, and the same end always turns toward the north. Several bars suspended in the same manner, and at a certain distance from one another, always place themselves in parallel directions. The vertical plane which passes through the axis of a bar freely suspended, when in its position of equilibrium, is called the magnetic meridian. The magnetic meridian does not coincide with the terrestrial meridian; the angle comprised between these two planes in a given place is called the declination. The declination is said to be east or west, as the half of the bar turned toward the north places itself east or west of the terrestrial meridian. The declination also changes in value and even in sign, according to the place of observation; and it undergoes, besides, continual variations at the same place.

Fig. 4.

The end of the magnet which turns toward the north is called its north pole, the opposite end its south pole.

If the poles of a freely suspended bar magnet are successively brought near the poles of another bar, the suspended magnet will be turned out of the magnetic meridian. The direction in which it is displaced in each case shows that poles of like names repel each other, while, on the contrary, poles of unlike names are mutually attractive.

If we place a string bar, M (Fig. 5), in any position whatever below a bar, M', whose suspension is without torsion, the latter bar immediately turns in a horizontal plane, and, after a few oscillations, comes to rest. In this position the axes of the two bars are parallel, and the poles of unlike names are placed one above the other, on the same side of the suspension thread.

Fig. 5.

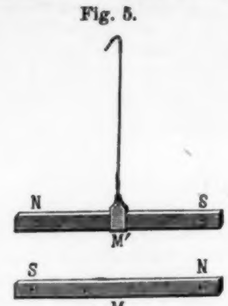


Fig. 6.

The terrestrial globe may therefore be considered as a great magnet, with one of its magnetic poles placed in its northern, the other in its southern hemisphere. The two hemispheres of the earth are thus like the two halves of a bar magnet—the northern hemisphere possessing the magnetic properties of the south pole, and the southern hemisphere exercising the same action as the north pole of a natural or artificial magnet.

If a magnetized needle is supported on a metallic point by an agate cup, M, placed on its center (Fig. 6), the needle is then free to turn in a horizontal plane. When left to itself, it oscillates under the influence of terrestrial force, and finally comes to rest in such a position that the line joining its poles, which corresponds with its center of figure, is in the magnetic meridian of the place.

By placing (Fig. 7) a bar of soft iron which presents no trace of magnetism in the neighborhood of the poles of a bar magnet, the former, under the influence of the magnet, acquires the property of attracting iron filings, and becomes itself a real magnet, with its two poles and its neutral line. In soft iron, magnetized by induction, the poles stand in a direction opposite to those of the bar; and its neutral line, instead of occupying the middle position, is placed in the neighborhood of the end which is opposite the bar.

Fig. 7.

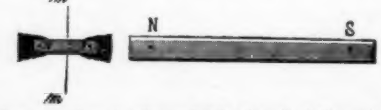
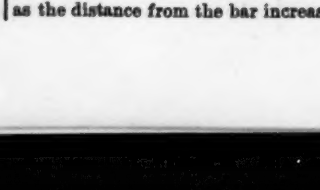


Fig. 8.

This magnetization, or inductive polarization, is only temporary, and completely disappears the moment the bar and the soft iron prism are separated some distance from each other. The phenomena are the same when a soft iron prism (Fig. 8) remains suspended by the attraction of one of the poles of a bar magnet.

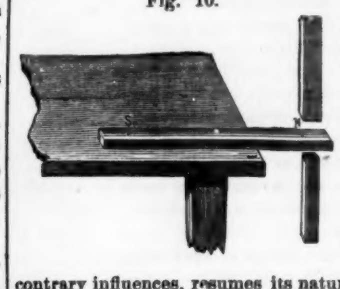
This temporary induced magnetism of soft iron prisms may be shown in another manner. If a soft iron prism is suspended from the north pole of a strong magnet (Fig. 9) it becomes capable of supporting a second prism; the second prism is in turn inductively magnetized, and will support a third, and so on. In this magnetic chain, the indirectly magnetized prisms always touch each other with poles of contrary names, and the action becomes weaker as the distance from the bar increases. But now, if the bar is detached from the first soft iron prism, all traces of polarization disappear in the several prisms, and they immediately separate from each other.

Fig. 9.



We have seen that a prism of soft iron, presented to the north pole of a magnet, becomes itself a real magnet by induction, the contrary poles attracting each other, and the soft iron remaining suspended against the force of gravitation. If, when a prism is suspended in this manner, the south pole of a second bar (Fig. 10) is brought near it, all magnetic adherence ceases; the soft iron prism detaches itself, and falls.

Fig. 10.



In this experiment, the second bar tends to develope in the prism a magnetization whose polarity is opposite to that developed by the first bar. The soft iron being thus submitted to the two contrary influences, resumes its natural state, loses all trace of polarization, and should necessarily obey the action of gravitation. Experience has demonstrated that when a bar magnet is broken, each of its parts, whatever may be their number, forms a complete magnet, with its two poles and neutral line. The magnetization induced in a piece of soft iron is less as the distance through which the bar acts is greater. From the preceding facts it appears that the action of a magnetic pole, on a series of soft iron cylinders submitted to its influence, very much resembles the induction exercised by an electrified sphere on a series of insulated conductors. Under the influence of the magnetic pole, the soft iron cylinders are polarized, and the polarization endures while the influence lasts. In the same way, the ends of the insulated conductors, placed in the vicinity of an electrified sphere, are charged with electricity of contrary names; this polarization lasts as long as the inductive action of the sphere is maintained, and completely disappears when the sphere is removed or discharged.

There is, however, a great difference between a magnetized bar and an electrified sphere. The contact of the soft iron by no means enfeebles the magnetic properties of the bar; but the magnetism, whatever its nature may be, does not, by apparent contact, pass from the bar to the piece of soft iron. On the contrary, when an electrified sphere is touched with an insulated conductor, a part of the electricity of the sphere is spread over the conductor, and the electric properties of the sphere are enfeebled.

Plants and Animals found in the Human Mouth.

According to Dr. C. N. Peirce, in an essay in *Dental Cosmos*, the following variety of organisms is found in the oral cavity, as shown by the microscope: 1. Oidium albicans. 2. Cryptococcus cerevisiæ. 3. Leptothrix buccalis. 4. Leptomitus. 5. Bacteria, vibrios, and monads. 6. Paramecia 7. Heterogeneous mass.

OIDIUM ALBICANS, OR WHITE PLANT.

As revealed to the observer, it seems to consist of thickened epithelial cells, mingled with numerous minute sporules or seeds, from the midst of which long, thread-like, jointed and branching plants arise, mycelium, intertwining with each other. The question as to whether this vegetable growth is the origin or sequence of disease has not yet been settled. So far as I can learn of its prevalence or predisposition, it occurs most frequently in the mouths of persons living in situations where the air is impure and diet unwholesome, or where previous gastric or intestinal disorder has interfered with the health and vigor of the infant. It is found alone or simultaneously on the inner edge of the lips, where the mucous membrane begins, on the inner side of the cheek, on the gums and palate, on the upper and lower surface of the tongue, in the throat, and in the œsophagus, down as far as the cardia, or upper opening of the stomach.

CRYPTOCOCCUS CEREVISIÆ—*Cell or Capsule.*

This plant is composed of round or oval cells, which present in their interior one or two little corpuscles resembling somewhat an oil globule. They are propagated with great rapidity when in contact with decomposing substances at a favorable temperature. This cryptococcus is so similar to that found in yeast, beer, ale, and sour milk that it may be considered practically identical, the principal difference noticed being a variation in the size; while in shape, manner of propagation, and apparent globule within, the modifications are but slight. It is developed in the morbid secretions of the mouth, the œsophagus, and stomach; it is also introduced into these situations by the drinking of beer.

In the black fur of the tongue of persons laboring under typhus, or in the oral secretions where persons have been long sufferers from organic disease, it is also found. Vogel thinks it of great importance to regard this plant only as an accompaniment and not as the cause of disease.

LEPTOTHRIX BUCCALIS—*Slender hairs in the mouth.*

This consists of slender structureless fibers, of various lengths, and straight or curved as the fiber is long or short. One end is free, the other is planted in or projecting from a fine granular mass, though a limited number are always noticed floating in the secretions, detached from any substance. They are found singly or in bundles, and multiply with great rapidity. Scarcely any portion of the mouth is free from them. They appear on the surface of the tongue, in depressions of the teeth, and cavities of decay, on the neck

and surfaces of the teeth; indeed, everywhere within the oral cavity that lodgment can be found for a particle of food.

They are found also growing from the surface of accumulations of tartar, whether such accretions be upon the necks of the teeth, in the cavities of decay, or on artificial dentures. There is probably no situation where they grow with greater rapidity than on the surfaces of the plate, either upper or under. The soft cheese-like substance that so quickly accumulates there is most prolific in their production, though from this situation they are neither so long nor attenuated as those taken from an inflamed mucous membrane. While great care in cleanliness limits their number, it is impossible to entirely eradicate them or prevent their development.

LEPTOMITUS—*Slender Threads.*

This growth, as the name indicates, is neither so long nor so slender as the leptothrix. It also has occasional branches, and marked transverse striæ, which complete its morphological difference from the plant just described. It is found upon the tongue and in the pharynx of persons suffering from pneumonia, pleuresia, phthisis, apoplexia, and chronic gastritis.

BACTERIA AND VIBRIOS.

These organisms form some of the most minute objects which the microscopist has the opportunity of examining, and it is with the greatest difficulty their structure can be accurately determined. They are both found in the fluids of the mouth, but the profusion in which they exist is modified by the care exercised in keeping the fluids of the oral cavity free from decomposing substances. In the fangs of teeth where the pulps are devitalized, they are found to rapidly develop. Nor is their presence in this locality confined to such teeth as have defective crowns giving communication with the fluids of the mouth; but in a number that were examined where there was devitalization of the pulp without any loss of the hard tissues from caries or otherwise, their presence was readily detected. Upon opening into such cavities, they were, as usual, very offensive from the degenerated pulp, and on examining this putrid material these living organisms were observed in abundance.

MONADS.

With these two low forms of life we must associate what are known as monads, or, as Bastian calls them, plastide particles. These are invariably found in the same solutions with the former, and are supposed by some observers to result either by direct growth and development, or by aggregation and coalescence into bacteria and vibrios.

"Naturalists have been in doubt as to whether they should be regarded as independent living things of the lowest grade, having an individuality of their own, or whether, rather, they should be looked upon as developmental forms of some higher organisms, either animal or vegetable."

The discovery of these low forms of life in the mouth is not of modern origin, as we shall see from the following by Leuwenhoek. In 1682, at the age of fifty years, he wrote respecting his teeth: "It is my custom every morning to rub my teeth with salt, and afterwards to wash my mouth, and, after eating, I always clean my large teeth with a toothpick, and sometimes rub them very hard with a cloth. By these means my teeth are so clean and white that few persons of my age can show so good a set; nor do my gums ever bleed although I rub them very hard with salt; and yet I cannot keep my teeth so clean but that, upon examining them with a magnifying glass, I have observed a kind of white substance collected between them, in consistence like a mixture of flour and water. In reflecting on this substance, I thought it probable (though I could not observe any motion in it) that it might contain some living creatures. Having therefore mixed it with rain water, which I knew was perfectly pure, I found, to my great surprise, that it contained many very small animalcules, the motions of which were very pleasing to behold. The largest sort of them had the greatest and quickest motion, leaping about in the fluid like the fish called a jack: the number of these was very small. The second sort had a kind of whirling motion, and sometimes moved in the direction of a spiral, and undulated; these were more in number. Of the third sort I could not well ascertain the figure, for sometimes they seemed roundish but oblong, and sometimes perfectly round. These were so small that they did not appear larger than a speck. The motion of these little creatures, one among another, may be imagined like that of a great number of gnats or flies sporting in the air. From the appearance of these to me, I judged that I saw some thousands of them in a portion of liquid no larger than a grain of sand, and this liquid consisted of eight parts water and one part only of the before-mentioned substance taken from the teeth.

"With the point of a needle I took some of the same kind of substance from the teeth of two ladies who I knew were very punctual in cleaning them every day, and therein I observed as many of these animalcules as I have just mentioned. I also saw the same in a white substance taken from the teeth of a boy about eight years old; and upon examining in like manner the same substance taken from the teeth of an old gentleman, who was very careless about keeping them clean, I found an incredible number of living animalcules, swimming about more rapidly than any I had before seen, and in such numbers that the water which contained them (though but a small portion of the material taken from the teeth was mixed in it) seemed to be alive."

PARAMECIA.

Having now considered all the growths deemed vegetable found in the mouth, I have still one other organism to describe, as to the true place of which in Nature there is no division of sentiment, it belonging undoubtedly to the animal kingdom. I allude to the paramecia, a genus of infusoria. They are only found in the oral cavity in cases of extreme uncleanliness; and though increasing rapidly in infusions adapted to their growth, they are somewhat limited in this situation, owing to the constant changing of the secretions. About fifteen varieties have been described. They have a soft flexible body, variable in form, though usually oblong or oval, and more or less depressed. In most of them, numerous rows of vibratile cilia are noticeable, projecting from their integument.

Useful Recipes for the Shop, the Household, and the Farm.

Vienna bread and Vienna beer are said to be the best in the world. Both owe their superiority to the yeast used, which is prepared in the following manner: Indian corn, barley, and rye (all sprouting) are powdered and mixed, and then macerated in water at a temperature of from 149° to 167° Fah. Saccharification takes place in a few hours, when the liquor is racked off and allowed to clear, and fermentation is set up by the help of a minute quantity of any ordinary yeast. Carbonic acid is disengaged during the process with so much rapidity that the globules of yeast are thrown up by the gas, and remain floating on the surface, where they form a thick scum. The latter is carefully removed, and constitutes the best and purest yeast, which, when drained and compressed in a hydraulic press, can be kept from eight to fifteen days, according to the season.

By drawing up the earth over the potato in sloping ridges, the plant is deprived of its due supply of moisture by rains, for when they fall the water is cast into the ditches. Further, in regard to the idea that, by thus earthing up, the number of tubers is increased, the effect is quite the reverse; for experience proves that a potato, placed an inch only under the surface of the earth, will produce more tubers than one planted at the depth of a foot.

Brown bronze dip, for coating hat hooks and similar small hardware articles, is made of iron scales, 1 lb.; arsenic, 1 oz.; muriatic acid, 1 lb.; zinc, solid, 10 ozs. The zinc should be kept in only when the bath is used. The castings must be perfectly free from sand and grease.

A good test for gold or silver is a piece of lunar caustic, fixed with a pointed stick of wood. Slightly wet the metal to be tested, and rub it gently with the caustic. If gold or silver, the mark will be faint; but if an inferior metal, it will be quite black.

Cider may be purified by isinglass, about 1 oz. of the latter to the gallon. Dissolve in warm water, stir gently into the cider, let it settle, and draw off the liquor.

The solvent power of glycerin upon several substances commonly used in medicine and the arts is as follows: 1 part of sulphur requires 2,000 parts of glycerin; iodine, 100 parts; red iodide of mercury, 340 parts; corrosive sublimate, 14 parts; sulphate of quinine, 48 parts; tannin, 6 parts; veratria, 96 parts; atropia, 50 parts; hydrochlorate of morphia, 19 parts; tartar emetic, 50 parts; iodide of sulphur, 60 parts; iodide of potassium, 3 parts; sulphide of potassium, 10 parts.

Some weeds can be killed and prevented from growing in garden paths by watering the ground with a weak solution of carbolic acid, 1 part pure crystallized acid to 2,000 parts water. Sprinkle from a watering pot.

A screen or blower of wire gauze, from 36 to 40 wires to the inch, placed in front of range or stove fires, will prevent, it is said, smoke coming into the room when the chimney fails to draw well.

To prevent condensation in a steam pipe laid under ground, place it inside another larger pipe, filling the intervening spaces with pulverized charcoal. The outside pipe should be watertight.

Tar water may be employed for dyeing silk or wool ashen gray. The stuff is first mordanted with weak perchloride of iron, by soaking in the solution some hours. It is then drained and passed through the bath of tar water. The oxyphenate of iron, which is thus precipitated on the fabric, gives a very solid color.

A cement, impermeable by air and steam, and especially well adapted to use for steam or gas pipes, is made of powdered graphite 6 parts, slaked lime 3 parts, sulphate of lime 8 parts, and boiled oil 7 parts, well kneaded.

Cider may be preserved sweet for years, by putting it up in airtight cans, after the manner of preserving fruit. The liquor should be first settled and racked off from the dregs, but fermentation should not be allowed to commence before canning.

The mordants used for dyeing with sumac are either tin, acetate of iron, or sulphate of zinc. The first gives yellow, the second gray or black, according to strength, and the third greenish yellow.

When boilers are ordinarily fed with hard water, it is worth while to save the drippings of the exhaust pipe, the condensation of the safety valve blow-off, and that from the cylinder, and use the water thus obtained to fill the boiler after blowing off. The result will be surprising in effect in loosening scale.

The evaporative efficiency of American anthracite and American bituminous coals is in the proportion of 8·9 to 9·9.

Glossed shirt bosoms: Take two ounces of fine white gum arabic powder, put it in a pitcher and pour on a pint or more of water, and then, having covered it, let it stand all night. In the morning, pour it carefully from the dregs into a clean bottle, cork, and keep it for use. A teaspoonful of gum water stirred in a pint of starch, made in the usual way, will give to lawns, white or printed, a look of newness, when nothing else can restore them, after they have been washed.

A cheap fertilizer consists of sulphate of ammonia, 60 lbs.; nitrate of soda, 40 lbs.; ground bone, 250 lbs.; plaster, 250 lbs.; salt, ½ bushel; wood ashes, 3 bushels; stable manure, 20 bushels. Apply the above amount to six acres. Labor in preparing included, it costs about $15. It is said to give as good results as most of the commercial fertilizers costing $50 per ton.

To make a handy paint, break an egg into a dish and beat slightly. Use the white only, if for white paint; then stir in coloring matter to suit. Red lead makes a good red paint. To thin it, use a little skimmed milk. Eggs that are a little too old to eat will do for this very well.

Magnetism of Iron Filings.

"De Haldat published, during 1836, in *Memoires de l'Académie* of Stanislas, that he had put iron filings into a brass tube (closed by two screw plates), which he magnetized by the ordinary process, and that he succeeded in obtaining two contrary poles. The polarity slowly decreased when varying quantities of river sand were mixed with the filings, while in every case it was very weak, and disappeared when the metal grains were displaced in position by shaking the tube. I repeated this experiment by firmly ramming down the iron filings into the tube, by means of a small hydraulic press. I found that when the filings begin to aggregate the polarity considerably augments, and continues to increase with pressure. I now lay before your Academy some tubes, 3·2 to 4 inches long and 1·2 inches in diameter, which attract at least as powerfully as those made from broken pieces of good steel of the same dimensions. As the iron filings which I used were of unknown origin, I had some prepared under my own eyes, from good soft iron, perfectly reduced, and without appreciable coercive force: the results were not lessened. Thus, then, a metal which has no coercive force when it is entire acquires it in as considerable a degree as that of steel when it has been reduced and compressed by pressure. Is it not to this fragmentary character that we must attribute the observed polarity? and is it not, also, this same cause which explains the coercive force of steel? One cannot explain the distribution in a magnet without considering it as composed of rows of very small magnetic elements of opposite poles, reacting between themselves at a distance; and it is proved that the quantities of separate magnetism in each of them increase, by this reaction, from the extremity to the middle line. Until now it seemed admissible that these elements are the molecules themselves; but the preceding experiment appears to show they are formed of either compacted iron fragments or small agglomerated crystals, as in steel. When, before pressing the filings, materials which render the mass more homogeneous are put with them, the same polarity can no longer be given to them as before the mixture. For example, if we make a paste of chloride of iron and filings, and press it, we obtain, after several days, a subchloride of iron of continued appearance, which may be filed and polished like pure iron, but which can scarcely be magnetized. Iron reduced by hydrogen and oxygen from scales behaves like iron filings; but magnetic or diamagnetic bodies mixed with the filings notably change its faculty of becoming magnetized. It is probable that, in very powerfully ramming home the powders, the coercive force would be found to increase to a maximum, and that it will afterwards decrease when the compactness of the fragments will have given a sufficient continuity to the mass."—*J. Jamin, in Comptes Rendus.*

Concrete for Walks, etc.

John Turner, in the London *Agricultural Gazette*, gives his experience in making and using asphalt as follows: "I have done a great deal successfully in walks and some kinds of floors such as the floor of a pig house, but have never attempted it for heavy traffic. It is neither difficult nor expensive. Of course a great deal depends upon the cost of material; the labor is trifling. I have used screenings of gravel (I don't like it clean, but mixed with sand); I have used sand alone (when I could not get anything better), blacksmiths' ashes, and ashes from my engine. The last I did was for our churchyard walks; for those I got the screenings of Leicestershire granite, which made a splendid path, but of course more expensive—the granite cost $2.50 per tun. It is quite an unnecessary expense and trouble to boil the tar. Get your material dry, mix it with tar, turn it over twice, and let it lie a couple of days, then turn it again, and mix a little lime with it, about a tenth, let it lie another day, and then on a fine sunny day lay it on, rake it even, and roll well as soon as it will roll, in an hour or two's time; if the roll does not work well (it ought to if the stuff is not mixed with two much tar), scatter a little dry sand over it. Every summer I brush my walks over with cold tar, and give a good sprinkling of sand, and they are as good now as when first put down, fifteen years since. Any laborer can do it, only take care, before laying it down, it is of proper consistence. When ready it ought not to show the least tar, but should be a dull dead black, and, when moved with a shovel, ought to be lively, exactly like a mass of mites in a cheese. The stuff will keep a long time in a heap if covered up or other wise kept dry."

Boiler Explosion.

Mr. R. Nickerson, of Harlem, Ga., informs us that a boiler at Sawdust, Ga., exploded on August 7. It was in a sawmill, and the building was torn to pieces. Parts of the boiler were thrown to a distance of several hundred yards. One man was blown to pieces, and two seriously injured. Mr. Nickerson states that the pressure gage showed 45 lbs.; but the gage was defective, as the practice (indulged in by the person in charge) of hanging car couplings on to the safety valve did not appear to form any increased pressure in the boiler.

Recent American and Foreign Patents.

Improved Stone Crusher.

Joshua Comly, Philadelphia, Pa.—This stone crusher has one stationary and one vibrating jaw. There is a toggle-bar contrivance in combination with the crank shaft and the rod connecting it with the movable bar in a manner calculated to apply very great force; also another device for giving vertical or endwise motion to the movable jaw, to be used or not, as may be found desirable.

Improved Wire Barb Pinchers.

John Dobbs and Benjamin F. Booth, Victor, Iowa.—This invention consists in the pinchers made with curved and notched jaws, and provided with projections upon the inner sides of said jaws, to adapt it for use in applying barbs to fence wires. In using the pinchers, an ordinary wire staple is placed in the space between its open jaws, with its arms resting in the notches in the inner edges of the faces of said jaws. The jaws of the pinchers and the arms of the staple are then placed around the wire of the fence, and the pinchers are closed. This forces the arms of the staple past each other until they rest upon stops and project in opposite directions, and the formation of the barb is completed.

Improved Combination Cotton Press.

John F. Taylor, Charleston, S. C.—The object of this invention is to produce a press of great power, especially adapted to compressing cotton bales to the smallest possible dimensions for shipment, and that with the greatest possible speed, and with the least possible consumption of fuel. It consists in the particular construction of a toggle lever press operated by steam, in combination with a hydraulic press, the steam in the cylinder that operates the water piston being used a second time in a cylinder which operates the toggle lever through the instrumentality of an equalizing part in the slide valve of the first steam cylinder.

Self-Discharging and Re-Setting Lumber Car.

James L. Ridgely, Jr., Harrisonville, Md.—This invention relates to cars or trucks whose wheels run upon a track to transfer lumber out of the way, after it has been sawn, to a convenient place for piling it up; and it consists in the combination of a truck running upon a suitable track of a load-receiving frame, having cross bars that form the bearing of the load, and pivoted on a median axis to said truck, whereby the lumber may be dumped by its own weight.

Improved Candlestick.

John B. Gribble, Grass Valley, Cal.—The core or shuttle has a screw thread cut on it. On the movable part of a tube, threads of a screw are made, which fit the pitch of the screw on the shuttle. The candlestick rests upon the upper end of the shuttle, and the latter is made fast in the stationary part of the tube. By this arrangement, the movable portion of the tube is adjusted to the candle, and the end of the shuttle prevents the tallow from running down.

Improved Self-Acting Blowpipe.

John Martin Hancock, Lansing, Iowa.—This is a self-acting blow pipe for hard and soft soldering, by which the flame would be fully and instantly controlled, and the power of the same regulated without interrupting the working of the blowpipe. The invention consists of a pipe attached sidewise and projecting to some distance from the alcohol vessel, which is exposed to the heat of a small flame, being about the same distance from the main flame of the lamp as the bottom of the alcohol vessel is from the outermost end of the blowpipe.

Improved Buffer for Steam Rock Drills.

Joseph C. Githens, New York city.—As the piston in its upper movement strikes the upper head, it forces the said head upward against the packing, and the blow is finally sustained by long bolts, which draw against the lower head. As the piston, in its downward movement, strikes against the lower head, the said head moves downward a little, and, through the long bolts, draws a plate down upon the packing, relieving the head from the force of the blow. By this construction, a single buffer at one end of the cylinder relieves the head from the force of the blows at both ends of the cylinder.

Improved Wagon Rack.

Joseph Bolt, Warsaw, Ill.—The object of this invention is to so improve the wagon rack heretofore patented to the same inventor, under date of February 10, 1874, that the loading, conveying, and unloading of corn may be accomplished by one person in an easy, quick, and secure manner. The invention consists of separate tilting frames, which are arranged on the supporting rack frame to swing to opposite sides, and carried back and retained with the load by cords with hooks and pulley blocks passing over pulleys to winding-up rollers, and ratchets operated by a hook lever. The rack frame is braced in rigid position by inclined bars extending from seat blocks at opposite sides through lateral guide pieces of the rack to the ground.

Improved Harrow.

Isaac W. Hutchin, Clinton, Ill.—Each of the two triangular sections of the harrow is composed of converging bars connected by transverse straps. The teeth are in suitable manner fastened in the bars. The two sections are hinged together so that their inner bars are parallel. The hinges are raised above the surface of the sections, and their connecting pivot is thereby brought high enough from the ground to clear corn of ten or twelve inches in hight. Each section has a projecting handle, and the two handles are united by a chain, which can be shortened so as to slightly raise the outer sides of the sections. This will cause the harrow to cut more in the center when harrowing corn stalks. By slackening the chain, the sections will be brought flat upon the ground.

Improved Vehicle Spring.

Christen Nielsen, South Brooklyn, N. Y.—The rear springs are attached to the rear axle, and their forward ends are pivoted to brackets attached to the wagon body. To the rear ends of the springs are pivoted links, the upper ends of which are pivoted to bracket. The shackles allow the springs to expand as they are brought under the pressure of the load. The couplings are kept parallel with each other to keep the springs from being twisted by brace bars. The forward springs are connected with the forward axle, and the forward ends are pivoted to brackets attached to the platform. The rear ends are connected by a bar, the middle part of which is bent upward, and has a hole to receive a bolt, which also passes through the bent down middle part of a bar pivoted to the ends of the bars of the platform and to the ends of bars which are pivoted to the springs.

Improved Device for Destroying Bugs upon Plants.

Robert M. Clark, Nisbet, Pa.—In using the device, Paris green or other suitable poison is put into a vessel suspended from the shoulders of the operator, either by taking off the cover or by pouring it in through a funnel in the same. A suitable quantity of water is then poured into the vessel through the funnel, in which may be placed a filter in case the water be so dirty that it would clog the perforated nozzle, which is attached to a faucet by a flexible tube. The poison and water are mixed by operating a perforated dasher, and are kept mixed by occasionally operating said dasher. The faucet enables the escape of the poison to be prevented when charging the vessel and when carrying it from place to place. The mixture is directed upon the plants from the nozzle.

Improved Apparatus for Destroying the Cutting Ant.

Ferdinand A. Fenner and John H. Power, Mission Valley, Tex.—In using this apparatus, the main cell of the ants' nest is found by means of an iron probe of suitable length, and a hole about eight inches in diameter is sunk to such a depth that its lower end may be a little below the lowest cell. The perforated and covered iron cylinder is then lowered into it, the collar of said cylinder resting upon the surface of the ground and closing the mouth of said hole. A fire is then built in the cylinder, and a blast of air is forced into it by a bellows connected with the end of a pipe which enters the side of the cylinder near the bottom pipe. When the fire is fully kindled, six or eight pounds of sulphur are poured into the cylinder, and the cover is put on. The bellows is then worked for from thirty to forty-five minutes, which forces the fumes of the sulphur through all the cells and passages of the ant nest and kills all the ants of the colony.

Improved Cotton, Corn, and Pea Planter.

Dwight W. Bristol and John F. B. Searcy, Pleasant Hill, Miss.—A drum, having twelve salient and as many re-entrant angles, revolves in bearings attached to the side bars of the frame. Within the drum is secured a smaller drum, in the middle part of which is secured a wheel, from which six radial tubes lead out through the faces of the drums. In the wheel, at the inner ends of tubes, are formed recesses, into which the seed passes through holes in the side plates attached to the sides of the said wheel and forming a part thereof. Upon the opposite sides of the wheel are placed circular plates, in which are holes corresponding in position with the holes in the side plates of the wheel, so that, by turning the disks, the size of the holes leading into the recesses in the wheel may be adjusted to allow more or less seed to enter the said recesses and pass out through the tubes.

Improved Vehicle Hub.

Joseph H. Lindsay, Freehold (Woodside P. O.), Pa.—The inner part of the hub has a ring flange to project over the collar of the axle arm, to serve as a mud band. Upon the outer side of the ring flange part are formed wedge-shaped projections, the spaces between which are dovetailed in form, so as to prevent the spokes, the inner ends of which are fitted into said spaces, from being drawn out. Upon the outer parts of the projections are formed segments of a ring flange, which enter a ring groove in the outer part of the hub, and thus strengthen the connection between the part of the hub. In the body of the hub is formed a chamber to receive the oil, from which chamber a hole leads into the bore. The hole is surrounded with a recessed projection, in which is placed a ball to act as a valve to prevent the oil from flowing through the hole when the wheel happens to stop with the oil chamber upward. From the oil chamber a hole leads out through the hub, through which the oil is poured into said chamber.

Improved Earth Auger.

Oscar Rust, Macon City, Mo.—The body of the auger is made elliptical in its cross section, and in two parts, the plane of division passing through the longer axis of the ellipse. To the lower end of each part is secured a jaw. The jaws project downward and forward, and are slightly concaved, and their lower ends pass each other. To the forward ends of the jaws are secured the bits, the edges of which are made oval, and have their corners rounded off. The outer ends of the bits are curved upward, and project outward a little beyond the walls of the pods, so as to cut a bore a little larger than the bucket, so that the said bucket can be readily raised and lowered through said bore. Braces are attached to the turned up outer ends of the bits. The parts are further secured together near their lower ends by hasps.

Improved Trace Carrier.

William H. Townsend, Goodland, Ind.—This is a frame adapted for attachment of harness straps, having rigid trace-supporting arms extending inward from its rear corners in a plane parallel to the side bars, and spring arms pivoted to a transverse bridge piece and coinciding with the arms. The trace-connecting straps are in this manner quickly applied and taken off.

Improved Wind Power.

Austin Lowe, Salina, Kan.—The invention relates to a portable wind power, which is designed for propelling wheeled carriages used for transporting loads and for furnishing a prime motor for operating thrashing machines, churns, plows, and other agricultural machines. The principal feature of the invention consists in the provision or relative arrangement to each other of a pair of wind wheels, which are of such a construction that both are brought into action simultaneously, and caused to revolve in reverse directions for transmitting motion to a vertical or main shaft, which is connected with the machinery to be operated.

Improved Plow Attachment.

Almerrin P. Allen, Denmark, Iowa.—The invention consists in combining with an ordinary plow a machine adapted for acting on the soil which has been turned by the plow, in such manner as to reduce, level, or pulverize the same, or plant it with seed, the side draft of the machine being opposed to the tendency of the plow to crowd in the opposite direction (laterally) against the vertical landside portion of the furrow, so that the power which would be otherwise uselessly expended or absorbed, in excessive friction between the landside of the plow and the contiguous wall of the furrow, will be all, or nearly all, neutralized and utilized in completing the operation of preparing the soil for reception of seed. The invention also includes a peculiar combination or arrangement of seed hopper, harrow, and roller, to form a plow attachment of light draft and great efficiency.

Improved Vise.

George W. Miliner, Charlottetown, P. E. I.—This invention relates to certain improvements in vises especially adapted to holding bolts or pipes; and it consists in a screw bolt having a T-shaped head and a handle nut, in combination with the extended handles of a pair of pipe tongs, constructed respectively with an oblong hole and an open slat.

Improved Animal Poke.

Samuel N. Gustin, Mexico, N. Y.—This invention relates to certain improvements in animal pokes, which, as usually constructed, have a yoke pivoted at the lower ends to a tongue, upon the rear end of which is a breast block provided with points, the whole being attached to the necks of unruly animals to prevent them from jumping fences, and to keep them within bounds generally. It consists in the improved construction of the pivot plate that attaches the yoke to the crosshead, the said plate being made with a tapering eye to facilitate the connecting of the said devices. It also consists in the means of attaching the crosshead to the tongue.

Improved Bottle Stopper.

George E. Reed, Brooklyn, N. Y.—The lower part of the stopper is provided with a shallow ring groove to receive a rubber band, which comes in contact with the mouth of the bottle. Around the upper part of the stopper is a metal band, in the upper edge of the opposite parts of which are inclines, the shoulders of which serve as handles for turning the said band. At the lower ends of the inclines are slots to receive a loop, to allow the stopper to be removed from the mouth of the bottle. Its ends are secured to the opposite sides of the bottle's neck by a wire band passed around the said neck. The stopper is fastened, when pressed into the mouth of the bottle, by turning the band, so that the inclines may press against the bend of the loop.

Improved Seed Cotton Cleaner.

Manassah C. Cheek, Mansfield, Tenn.—This invention consists of a secondary spiked fan cylinder and open concaves formed of wire rods, in combination with the ordinary spiked fan cylinder to counteract the air blast from the first cylinder, and direct it down through the open concaves, and also to detach the cotton from said cylinder and pass it along to the discharge opening through the case, thus cleaning and delivering the cotton better than the ordinary cleaners will. It also consists of a suction fan in the dust chamber below the spiked fan cylinders, to increase the draft through the dust chamber.

Improved Chair.

Henry Reupke, Chicago, Ill., assignor to himself and Frederick W. Krause, of same place.—The seat rails pass through the uprights of the chair back by a tenon, and are fastened therein by keys. The lower ends of these uprights are toed into the rear legs, thus bracing the back securely. Stretchers pass through the legs (front and rear) by means of tenons, are secured by keys, and are connected together by a center bar. The front and rear legs are slotted at their upper ends, and gains are cut in the seat rails, so that the rails and legs fit together, and are flush on each side. The back of the chair is filled in by an upright bar and a cross bar. The head piece is let into slots in the upper ends of the side pieces, and is fastened by screws, while tenons on the cross bar pass through the side pieces and are secured by keys. This chair may be taken to pieces by removing the keys and screws, so that it may be packed in a small space for storage or transportation.

Improved Die for Forming the Eyes for Tools.

John R. Thomas, Hamilton, Ohio.—This is an improved adjustable punch and die for forming the eyes of agricultural and other tools, such as a hoe, axe, adze, etc., so that the diameters and shapes of the eyes may be varied without the necessity of having a corresponding number and variety of dies and punches for the purpose. The stock of the punch is slitted transversely, and the divided parts may be expanded or spread more or less by means of a tapering pin. A tapering nut screws on the stock or body of the punch, and constitutes the punch proper. The punch is employed with a die, the size of aperture of which is adjustable.

Improved Machine for Rolling Nail Plates.

Hiram Woods, Newcastle, Pa., assignor to himself and William F. Merriman, of same place.—A movable table fetches the plate from the roughing rolls, and presents it to a self-feeding roll, above the upper roll, to be carried over the roller's side and on to an inclined feeding table. Besides taking the plate from the movable table without the aid of the hooker-up, the roll delivers the plate without the aid of the hand.

Improved Washing Machine.

John W. McQuillin and John A. Knepper, Delta, Ohio.—By suitable construction, as either end of a lever is pressed downward, a presser connected with that end is forced down upon the clothes, forcing the water out of them, which water escapes downward through a grate, upward through the presser, and laterally through the other part of the clothes, which are relieved from pressure by the upward movement of a second presser, and so on. One of the pressers always moves downward as the other moves upward, thus washing the clothes in a short time.

Improved Straw Cutter.

Leopold Schellinger, Mishawaka, Ind.—The invention is an improvement in the class of straw cutters in which the rollers for feeding the straw and the bar for clamping the same while being cut are operated from the shaft of the hand wheel, to which the knives are attached. By suitable construction a saddle, at each revolution of the eccentric, will be drawn upon the substance in the feed box and then raised. The fly wheel and the eccentric wheel are so arranged that the saddle will be drawn down as the knife begins to cut, and will be raised as the cut is completed. By other devices the rapidity of the feed may be regulated as may be required. The feed rollers revolve toward each other to feed the substance forward, and the upper roller moves up and down to adjust itself to the thickness of the substance without being thrown out of gear. The feed mechanism is so arranged as to stand still when the saddle is pressed down, and to operate when the said saddle is raised.

Improved Apparatus for Measuring Liquids, etc.

Emile E. P. Clausolles, Barcelona, Spain.—This apparatus consists of bellows, formed of annular disks, which are in communication with the ingress and egress passages formed in the foundation plate of a box. The bellows are united by the arms of a compound lever, which vibrates in a spherical recess in a fixed stand, and the lower end of the axis of this compound lever communicates a rotary motion to a circular valve, which opens and closes the ingress and egress ports. The upper end of the axis gives motion to the index dials or to a rotary shaft for transmitting power or to pumps. The bellows are made to contain a certain fixed quantity of liquid, and the pressure on the liquid to be measured causes the said bellows to expand and collapse alternately.

Improved Gas Regulator.

Joseph Adams, Washington, D. C.—This invention relates to certain improvements upon the gas regulator for which letters patent were granted to the inventor May 5, 1874; and it consists in the construction of the valve, which is of a funnel shape and provided with an outer covering of flexible material secured by a nut and funnel-shaped clamp upon the inner and lower side of the valve. It also consists in the particular construction and arrangement of the hollow valve stem with the flexible diaphragm and the balloon.

Improved Heating and Ventilating Register.

John B. Oldershaw, Baltimore, Md.—This invention relates to that class of heating and ventilating registers that are inserted in the chimney jamb when the chimney flue is employed for conducting the hot air. It consists in an extensible flue stopper, adapted to be inserted in the chimney flues of different sizes, to deflect the current through the register, and in the particular construction of the register frame having openings for giving access to the flue, either above or below the flue stopper plate, for cleaning off soot and examining and adjusting the stovepipe connections.

Improved Horseshoe.

Joseph H. Dorgan, Plattsburg, N. Y.—A strap is made in three parts. A piece laps on the central part on each side, and is fastened thereto by bolts. A series of holes is made through the central part, which allows the pieces to be adjusted, so as to make the strap fit hoofs of different sizes. A bolt passes up through the shoe, and through a hole in the front part of the strap. The ends of the flexible plate or band may be expanded or contracted to accurately fit hoofs of different widths, while the lap pieces may be adjusted according to the length of the hoofs.

Improved Water Elevator.

Jesse Chandler, Barry, Ill.—This invention relates to endless chain and bucket elevators. The buckets have a block on the under side to throw up the bottom, when passing over the one upper wheel, high enough to discharge readily. The second top wheel is placed a little lower than the first, also to tilt the buckets so as to empty readily. The flanges of the wheels are also employed to utilize those of the wheel, to conduct the water first emptying from the buckets over sufficiently to run into the trough.

Notes & Queries

A. K. will find a recipe for water glass on p. 225, vol. 23.—A. F. will find directions for making a sun dial on p. 409, vol. 29.—F. J. C. will find directions for making colored glass on p. 390, vol. 30.—J. N. will find a recipe for blackboard composition on p. 91, vol. 31.—J. N. can utilize the tin of tinned plate scraps by the process described on p. 319, vol. 31.

(1) J. H. asks: How can I make pure chloride of gold and nitrate of silver from United States gold coin? A. Dissolve the coin in a limited quantity of a warm (not hot) mixture consisting of one part nitric and three parts hydrochloric acid. When solution is complete, filter from the white residue of chloride of silver; dilute largely with distilled water, and add a filtered aqueous solution of common sulphate of iron (6 parts to 1 of gold); collect the precipitated gold, which is now free from copper; redissolve in aqua regia as at first, and evaporate to dryness on a water bath. Place the filter paper containing the chloride of silver, along with a quantity of borax, in a small Hessian crucible, and heat strongly until the silver is separated and rests as a small button on the bottom of the crucible; remove from the fire, cover, and allow to cool. Then separate the silver from the borax by means of boiling water; dissolve in nitric acid, and evaporate to dryness on a water bath.

What chemicals will act as a bleaching agent when exposed to sunlight? A. Moisture, chlorine gas, chloride of lime, etc.

(2) M. H. K. asks: What is the green substance that gathers on the outside of a porous earthenware drinking vessel? Does it come from the water inside, or from the atmosphere? It washes off readily, and resembles the green slime of stagnant waters. A. It is probably due to the quantity of organic matter dissolved in the water, which, on evaporating, leaves it behind in the form you mention. Test a little of the clear water by coloring it slightly with permanganate of potash; if, after standing for some time, the color disappears, the water is unfit for drinking purposes.

(3) S. D. G. says: I have a steam whistle which sounds well at 100 lbs. steam. If I now raise steam to 1,000 lbs. what effect will it have on the whistle? Can it be heard so much farther, or will it fail to sound at all? A. It is problematical whether the expansion of the metal would not altogether alter both the tone and effectiveness of the whistle.

(4) W. M. J. says: The boiler of a thrashing machine engine recently exploded at Lexington, Md. On examination it was found that the safety valve was stuck fast in the guide, it being a light globe valve with a stem about 3½ inches long, like a common globe valve stem, with thread left off, being a close fit. I am under the impression that the hand had gone once clear around and up to the 65 lbs., as the sheets do not show any signs of having been over heated. A. The safety valve stem being fast totally impaired the efficiency of the boiler, and it is possible that the needle of the pressure gage (if the construction of the gage would permit) had made more than an entire revolution. The pressure in such case is an unknown quantity; hence the explosion.

(5) J. C. asks: Is it possible to plane a piece of hardened steel? A. It is impracticable, and would be, if it could be done, disadvantageous.

(6) C. W. M. asks: 1. If I make an engine of brass, it will turn blue when heated. Will the color change if I plate it with nickel? A. No. 2. How large a copper boiler should I have for an engine 1½x3 inches, and how thick should the shell be? A. Size of boiler about 8 inches diameter and 15 inches long; shell ⅛ inch thick for moderate pressure. 3. Should it be brazed or riveted? A. It should be brazed and riveted. 4. Will ports ⅛x⅝ inches be large enough for a 1½x3 inch cylinder? A. You will find a rule for size of ports in No. 16, etc., of Practical Mechanism.

(7) W. E. S. says: A friend of mine asserts that, in a common bucket pump the only water lifted by the bucket is that which is above the bucket. Is he right? A. Yes.

(8) A. D. T. says: In my daily experience in the use of twist drills, I have remarked one improvement which a manufacturer might make. It is this: Flatten three sides of the shank; this will do away with all slipping. Also put a good center in the shank. All this can be done at very little expense and cannot fail to give great satisfaction. A. Twist drills ¼ inch and over in diameter usually have a taper shank, and a feather on the end which effectually holds them. Those below that size, and those having parallel shanks, may be held sufficiently firm in an ordinary chuck. It would be difficult to make triangular holed chucks run true.

(9) A. C. T. says: I have seen an article in relation to a certain alloy of metals, which when melted was of the required degree of heat for tempering edge tools. What is it? A. We know of no special alloy for that purpose. Common lead is sometimes used, the work being greased before immersion.

(10) L. H. R. asks: 1. I have two shafts situated 24 inches from center. I have an endless belt 66 inches long. How can I find the diameter of two pulleys, both to be the same size, on which this belt will fit tight? A. Subtract twice the distance between the centers of the shafts from the length of the belt, and divide the remainder by 3·1416; the quotient will be the required diameter of each pulley. 2. Under similar circumstances, the size of one pulley being given, how can I ascertain the correct diameter of the second? A. To twice the distance between the centers of the shafts, add half the circumference of the given pulley, and subtract their sum from the length of the belt: the remainder, multiplied by 2 and divided by 3, will give the diameter of the second pulley.

(11) G. D.—It is likely that the law of your State, forbidding the sale of goods manufactured under your patent without a seller's license, may be enforced; but by a number of judicial decisions, you are at liberty to travel in any State or Territory and sell rights to manufacture under your patent, and no State legislation can legally stop you.

(12) H. M. says: We are putting up a horizontal engine. Please give us your method of getting out the template, and the lines and right angle line for back box, distance, etc. A. The cylinder and crosshead guides are set true horizontally, and parallel with the bed frame. The crank shaft is set by running a line, true with the bore of the cylinder, the full length of the bed, and setting the crank shaft at a right angle to it, keeping all parts level with a spirit level.

(13) A. M. B. asks: What kind of steel shall I use for making a gun barrel? A. Forge it from a square bar of soft machine steel of not too fine a quality.

(14) J. N. P. asks: What is the rule for calculating the strength of boilers, steam pipes, etc.? A. "For calculating the strength of a singly riveted steam boiler, multiply the internal diameter of the boiler in inches by the pressure of steam in lbs. per square inch, and divide the product by 8·900. The quotient is the proper thickness of the boiler plate in inches."—*Bourne.*

(15) A. H. D. says: We turn our axle nuts in soda and quinine, and put them away without cleaning or oiling, and they rust. Is there a way to keep them from rusting without much expense or labor? A. Coat them with boiled oil and white lead, mixed to a thick paint.

(16) C. P. asks: 1. Is the temperature in the hot air space of furnaces, used for heating purposes, enough to make steam? Yes, generally. 2. My house is heated by steam, but not satisfactorily, and I thought of putting in a furnace with a boiler inclosed in the air chamber, believing that I should get the heat of the furnace for the lower floors, and make steam enough for the upper stories. Would it work? A. This plan will answer if properly constructed.

(17) J. G. asks: 1. Could I have a brass cylinder, 2x4 inches, made, that would be equal to one half horse power? Yes. 2. Would it be a high pressure engine? A. Yes. 3. Could a small boat be fixed so that the wheel can be propelled with one cylinder? A. Yes.

(18) W. S. S. says: If I place two cylinders, 10x30 inches, side by side, and connect them with a pipe, stop cocks, etc., and attach to the pipe a small engine, cylinder 2x2 inches, and if I fill cylinder No. 1 with compressed air, 200 lbs. to the square inch, and cylinder No. 2 is empty, and if the air from No. 1 is liberated through pipe and engine to No. 2, and I keep the pressure to a minimum of 200 lbs. per square inch until all the air is forced into No. 2: What power will I obtain, and how long will it take to empty No. 1 into No. 2, and so on, alternately? A. Your power will depend upon the point of cut-off and the speed of the engine, and would gradually decrease, as the air entering cylinder No. 2 would create a constantly increasing back pressure upon the engine which would prevent cylinder No. 1 from ever becoming empty. The time necessary to bring the engine to a standstill in consequence of the above back pressure of course depends upon the size of cylinder No. 1.

(19) C. E. K. Jr. asks: For vulcanizing rubber plates I have a small boiler, 4½x5½ inches which I heat up to 320°. I fill it about ¼ full of water, and then put in the flask, which makes the boiler about half full. Is all the water converted into steam at a temperature of 320°? If not, what temperature would it take to convert it into steam, and what amount of pressure should I have? A. Only a small portion of the water is converted into steam, and it would not be practicable, with an ordinary apparatus, to evaporate it all in the closed space.

(20) J. T. says: I send you a piece of scale from a boiler. What is in the water to make such scale, and what will take it off? A. A good feed water heater will probably be efficacious in preventing further deposit; and it is probable that annate of soda will loosen what is already formed.

(21) T. McG. asks: What welding mixture used on vises to weld the faces on the jaws? A. For welding steel to iron, borax will do.

(22) F. M. asks: Please tell me of a remedy for cold feet. A. A fast walk of 2½ miles, morning and evening, is in most cases a sure cure.

(23) H. L. S. says: 1. I have an engine 1¼x3 inches, with a fly wheel 10 inches in diameter. Would it be large enough to run a skiff 10 feet long and 2 feet wide, with a pressure of 40 or 50 lbs. of steam? A. It would be better to use a steam pressure of 100 or 125 lbs. per square inch. 2. What size of boiler would it take? A. Make a boiler with from 20 to 25 square feet of effective heating surface. 3. Could a boiler be made to give that amount of power, using gasoline as fuel? A. Unless you have had experience in the use of gasoline as fuel, it would be better to depend upon coal or charcoal.

(24) H. M. N. asks: Which will be the most economical way of feeding a boiler, by a steam pump driven by an engine, or by an injector? A. The pump driven by the engine will be the most economical in general, but not the most convenient or desirable in all respects.

(25) W. J. N. says: I have a small boiler 8 inches in diameter and 2 feet long, and propose to enlarge it by having a double shell of $\frac{3}{16}$ iron made, having a water space of 2 inches between the skins. The shell is to be 3 feet high, with an outside diameter of 16 inches, and an inside diameter of 12 inches. Inside of this, I intend to suspend my old boiler, connecting the walls and steam spaces by ½ inch pipes. I will make the lower part of the shell act as a firebox, fitting a door at one side and putting in four cross tubes through the furnace one inch in diameter. Is this a practicable plan? A. If you make the connections so as to secure good circulation, there is no reason why the arrangement will not prove satisfactory.

(26) J. W. S. asks: How can I melt German silver? It runs well enough; but when we roll it it is full of scales. A. Do not add the zinc until the copper and nickel are fused together, and put in a little borax with the zinc.

(27) J. B. R. says: Your paper of August 14 contained an article referring to paper suitable for copying purposes. I enclose a sample of an okra paper, originated by me a few years ago. Until I saw the article referred to above I had never tested my new paper for copying purposes. I think I have reason to be satisfied with the result. You will see that the copying is as distinct as if done with the best Japanese tissue paper; and this has been accomplished with paper that was manufactured for ordinary newspaper printing. The strength of this paper is such as to adapt it for copying important documents, legal papers, etc., while there is no doubt that the paper may be made still heavier (if desired) and yet answer for making distinct copies. Another purpose for which this paper would be well adapted would be in the manufacture of vegetable parchment. A. The paper you send is a fine specimen of exceeding toughness, and is, we think, the strongest unsized paper we have ever seen. It is an admirable copying paper, and would answer well for the purpose you suggest.

(28) F. C. W. asks: What is the best metal for an expansion tube for hot water? A. Copper.

(29) M. R. says: 1. I send a sample of stuff found in a reservoir for condensed steam from an engine. We run steam through 650 feet of pipe (the last 100 feet of which is perpendicular) to a steam pump, the cylinder of which is 8x10. I have found the same material in every spare space between the engine and the pump, making it necessary to clean it out every six months. There has not been any grease in the pipe. I should like to know what it is. A. It resembles the material produced by the action of impure grease on the piston. Examine the piston of your engine and see whether or not it is changed in places into a charcoal-like substance, that can be readily cut with a knife. 2. I have had a discussion about the distance that water can be raised with a siphon. One claims it could be raised any distance, provided the discharge end was low enough, while I claimed that it could not be raised more than 34 feet. Which is right? A. You are.

(30) M. W. asks: Will you explain in your answers to correspondents how a locomotive will run around a curve, the outside rail of the track on the curve being longer than the inside rail, and the wheels, of the same size, being keyed on the axle at both ends? A. Under the circumstances, the wheels would slide on one of the tracks.

(31) W. P. asks: 1. Is there more pressure on the top side of a boiler than on the lower side, or is there the same pressure upon every square inch in the boiler? A. There is a little more at the bottom. 2. What is the rule for calculating the horse power of an engine? A. See p. 33, vol. 33.

(32) R. M. says: We want some black paint for smoke stacks that are heated nearly red hot. Is there such a paint? A. We know of nothing that will stand such a temperature.

(33) R. F. H. says: I have a coarse half round file, 6 inches long, which has been in use for some time. It has become quite strongly magnetized, with the south pole at the tip and the north pole at the tang. Is not this unusual? A. Such an example as you notice is interesting, and not at all usual. Perhaps some of our readers may have observed similar instances.

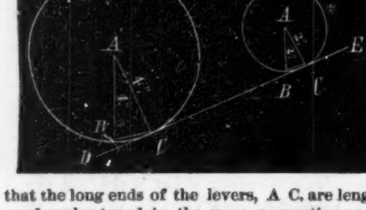
(34) G. W. I. asks: 1. What practical gain would result from the use of a feathering wheel instead of the ordinary paddle wheel, in the propulsion of steamboats? A. Increase of speed or diminution of power required. 2. Does the float or paddle exert the most force as it enters the water or as it leaves it? A. There is very little difference.

(35) J. W. W. asks: Will paraffin in nitric and sulphuric acids act the same as nitro-glycerin? A. Paraffin is not suitable for this purpose.

(36) W. A. says, in reply to W. H. P., who asked how a solution of ammonio-sulphate of copper may be rendered colorless and still retain all the copper in solution: Add potassic cyanide. The composition of the solution is altered, but the copper is all there. It may appear dark brown when fresh, but this is due to a little iron in the copper sulphate, and will subside on standing.

(37) M. W. W. says, in answer to the question: Shall we attach a horse to his load at a high point or a low? If the load is light and is to be propelled at considerable speed, it perhaps makes but little difference. Possibly it might be advantageous to put it level with the point of draft, as (see your reply to K. C. & Co., No. 40, July 10, 1875) would seem to be your opinion. But if the load is heavy, and the horse will have to exert himself to propel it, it will be, as experience has demonstrated fully, not only advantageous, but frequently absolutely necessary to make the attachment so low that he may have to exert some lifting as well as propelling force; and the *rationale* of this is that the animal has not weight enough to keep him from pushing his feet backwards instead of pulling his load forward, and he requires to be supplied with it from some other source. I have seen a horse pull a load with a man on his back that he was unable to move without; and any person who has not tried it will be surprised to see how light a load will stall a team when the attachment is such that it is required to exert some downward pulling force. This consideration is also implicated seriously in the practical operation of tractive engines, and their efficiency would be greatly increased by any device by which the engine could be given the benefit of a portion of the load to hold it to the ground or track, preventing slipping and carrying unnecessary weight.

(38) M. W. W. says, in reply to several inquiries in regard to the draft of high and low wheeled vehicles: A high wheel will be more easily drawn over any small obstruction in the road (such as a stone or stick), or out of a rut, or through mud; but whether this is the case on an ascending grade is a question not easily determined. It has been asserted that a man will draw a heavier load up a given incline on a small wheeled truck than on a large wheeled one, and the theory for it is that a perpendicular line drawn from the center of the axle falls nearer to the point of contact between the wheel and floor; this is equivalent to the short end of a lever, the distance from the axle to the point of contact being the long end. At first this might seem plausible, but an examination of the accompanying engraving will show



that the long ends of the levers, A C, are lengthened or shortened in the same proportion as the short ends, B C, and therefore no advantage is gained by that means. We must, therefore, look for some other explanation, and perhaps the readers of the SCIENTIFIC AMERICAN can clear up the difficulty.

(39) E. D. R. says: If E. B. W. would mix a strong infusion of quassia with his ink, he would have no more trouble with flies eating his inked lines.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. G. A.—No. 1 is magnetic oxide of iron. No. 2 is probably an alloy of tin and lead; but the sample is too small for a decisive report. No. 3 is a variety of bituminous coal containing considerable percentage of ash.—J. M. B. Jr.—It is a poor variety of porcelain clay.—M. S.—It is a poor pig iron, containing an unusual amount of earthy material.—C. G.—It is quartz, inclosing particles of iron pyrites. It is of no value as an ore.—R. L.—It consists of felspar and calcite, inclosing mica and a few crystals of garnet.—S. G. R.—It is refined tin. It never occurs native as you found it, and was undoubtedly left there by some person.—J. H. T.—It is a formation of variegated clay upon shale. It has been hardened by exposure.—W. B. H.—No. 1 consists principally of antimony. No. 2 is galena. No. 3 is impure galena. No. 4 is a fine conglomerate.—D. W. W.—To determine the value of an ore, it is necessary to have a quantitative analysis made.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells nitro-glycerin? Who makes canvas tents? Who buys corundum in lump? Who sells aluminum in sheet and wire?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week ending

August 17, 1875.

AND EACH BEARING THAT DATE

Those marked (r) are reissued patents.

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DESIGNS PATENTED.

8,563.—HEATING STOVE.—W. C. Davis, Cincinnati, Ohio.
8,564 to 8,566.—CARPETS.—A. Heald, Philadelphia, Pa.
8,567.—HEATER.—P. Rollhaus, Jr. Brooklyn, N. Y.
8,568.—RANGES.—W. Whitman, Bangor, Me.
8,569.—CLOCK CASE DOORS.—L. E. Jerome, New Haven, Conn.
8,570.—CAN HANDLES.—H. Miller, New York city.
8,571.—FORK HANDLES.—L. R. S. White, Waterbury, Conn.

SCHEDULE OF PATENT FEES.

On each Caveat	$1
On each Trade mark	$2
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, August 19 to 26, 1875.

5,076.—H. E. Casgrain, Quebec. Illuminating gas machine. August 19, 1875.
5,077.—E. V. Wingard, Pittsburgh, Pa., U. S. Burning bricks. August 24, 1875.
5,078.—J. Hewitt, Hamilton City, Pa., U. S. Ore crusher and stone breaker. August 24, 1875.
5,079.—A. Nye, Jr., Boston, Mass., U. S. Telescopic feed bag. August 24, 1875.
5,080.—J. Steger, New York city, U. S. Air brake. August 24, 1875.
5,081.—E. H. Gratiot, Plattsville, Wis., U. S. Wheat steamer. August 24, 1875.
5,082.—G. R. Moore, Westford, Mass., U. S. Scull propeller. August 24, 1875.
5,083.—G. Isles, Montreal, P. Q. Differential compass. August 24, 1875.
5,084.—T. Saunders *et al.*, Toronto, Ont. Burglar and fire proof safe. August 24, 1875.
085.—D. M. Kelley, Athelston, P. Q. Bolt and rivet trimmer. August 24, 1875.
5,086.—C. G. Force, Jr., Cleveland, Ohio, U. S. Device for excavations for sewers, etc. August 24, 1875.
5,087.—W. Lightfoot *et al.*, Toronto, Ont. Lawn sprinkler. August 24, 1875.
5,088.—T. H. Marsh, Toronto, Ont. Clamp. August 24, 1875.
5,089.—E. A. Calahan, Brooklyn, N. Y., U. S. Signal and alarm telegraph. August 24, 1875.
5,090.—W. Johnston, Shelby, N. Y., U. S. Door hanger. August 24, 1875.
5,091.—J. Gerhardt *et al.*, Montreal, P. Q. Portable resawing gang saw. August 24, 1875.
5,092.—P. M. Thompson, Derbey, Vt., U. S. Pipe wrench. August 24, 1875.
5,093.—J. Klink, Keswick, Ont. Meat-preserving process. August 24, 1875.
5,094.—J. J. Curran *et al.*, Chicago., Ill., U. S. Lumber dryer. August 24, 1875.
5,095.—P. C. St. Marie, Montreal, P. Q. Screw windlass for vessels. August 26, 1875.
5,096.—J. J. Stewart, Sargentville, Me., U. S. Pegging jack. August 26, 1875.
5,097.—F. Van Doren, Adrian, Miss., U. S. Corn planter. August 26, 1875.
5,098.—H. Sprague, Churchville, N. Y., U. S. Wagon. August 26, 1875.
5,099.—D. P. Sharp, Ithaca, N. Y., U. S. Horse rake. August 26, 1875.
5,100.—J. and F. A. Bailey, Farmington, Mass., U. S. Fruit pickler. August 26, 1875.
5,101.—J. Clay *et al.*, Montreal, P. Q. Fire lighter. August 26, 1875.
5,102.—J. B. Fayette, Oswego, N. Y., U. S. Lifting jack. August 26, 1875.
5,103.—M. and W. Fitzgibbons, Galt, Ont. Washing machine. August 26, 1875.
5,104.—J. Benson, South Boston, Mass., U. S. Vapor burner. August 26, 1875.
5,105.—J. C. Moore *et al.*, Philadelphia, Pa., U. S. Cans for shipping oils, etc. August 26, 1875.
5,106.—N. Silverthorn, Toronto, Ont. Hog-cleaning machine. August 26, 1875.
5,107.—W. R. Anderson, Cleveland, Ohio, U. S. Boiler flue cleaner. August 26, 1875.
5,108.—S. Ballerchey, Elderslie, Ont. Adjustable plow heel. August 26, 1875.
5,109.—S. Mitchell, Lima, N. Y., U. S. Carriage hub. August 26, 1875.
5,110.—J. T. Burns, Springhill, Ont. Root cutter. August 26, 1875.
5,111.—R. Sadler, Owen Sound, Ont. Elevator and snow shovel. August 26, 1875.
5,112.—J. W. Grover, Westminster, Eng. Spring washer. August 26, 1875.
5,113.—J. H. Hussey, Baltimore, Md., U. S. Protective toe shoe. August 26, 1865.
5,114.—D. McPherson, Caledonia, N. Y., U. S. Binder. August 26, 1875.

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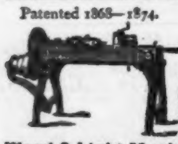

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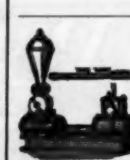

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